

# PAINT and VARNISH

*Production*

THE TECHNICAL MAGAZINE FOR MANUFACTURERS OF PAINT, VARNISH, LACQUER AND OTHER SYNTHETIC FINISHES

VENTION

ISSUE

POLYOLS

In

ALKYDS

See page 43

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OCTOBER  
1958

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**RCI 1952 WALLKYD**  
in low luster exterior formulations  
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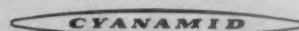
**Green**—Phthalocyanine and Chrome • **Yellow**—Hansa and Chrome

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**Red**—Lithol, Para, Toluidine, Bonadur (BON) and Permatone

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COLOR IS THE DIFFERENCE



# PAINT and VARNISH

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NO. 11

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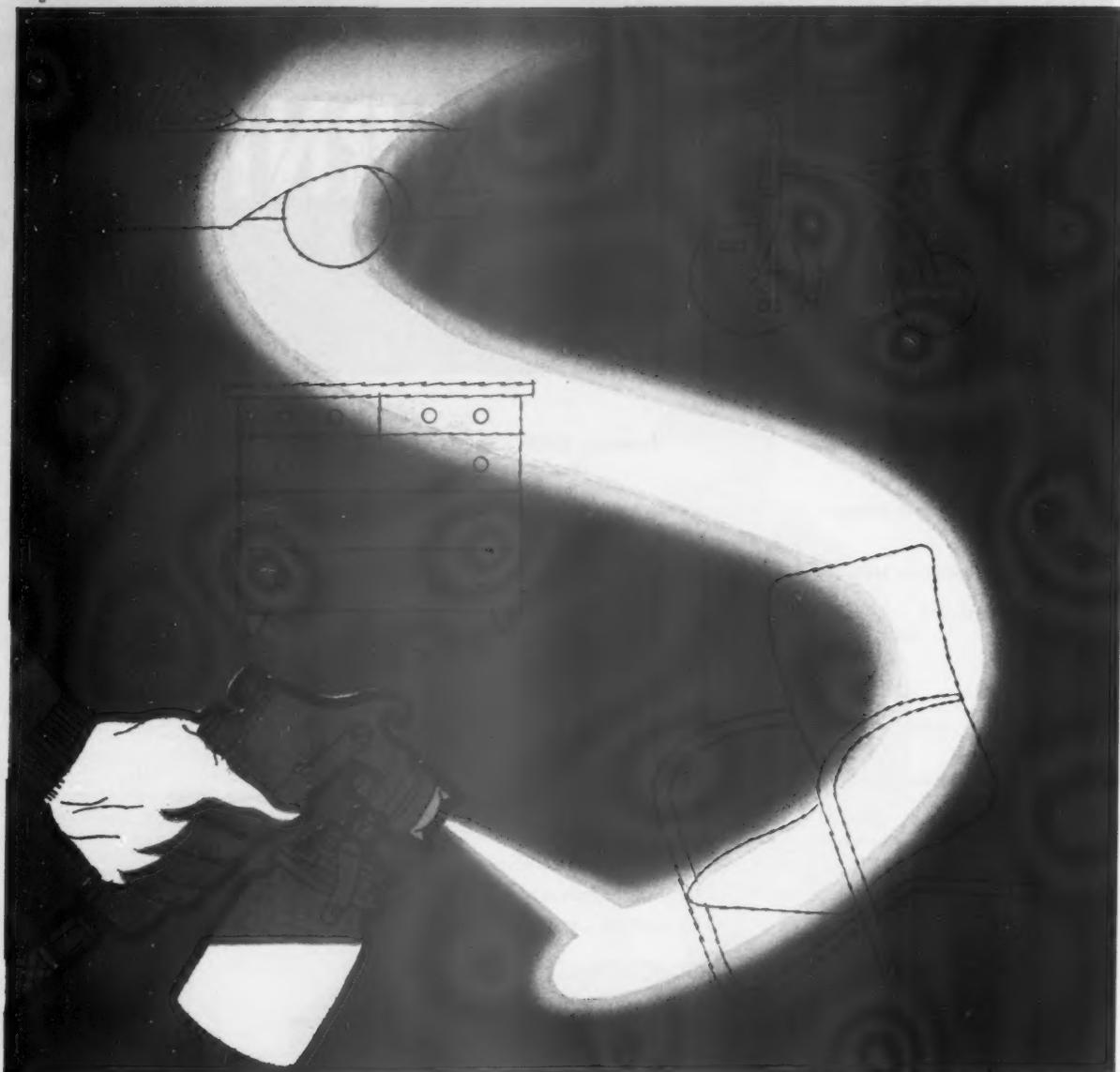
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# EDITORIAL COMMENT

## See You in Washington

THE National Paint, Varnish and Lacquer Association will hold its 71st annual convention in Washington, October 27-29th.

In a recent weekly report to the Association members, President Joseph F. Battley stressed the need for more high-level thinking, and increased concentration on research and development in the paint industry; along with improved marketing, merchandising and selling techniques. He also drew attention to the coming boom era which Leo Cherne, noted economist, described as the Fabulous '60s'.

To prepare the paint industry for the great and challenging opportunities that lie ahead, the Association has arranged an informative program appealing to all managerial levels within the paint industry.

A new and special feature of this year's convention will be an all day session devoted to "Work Shops". These "Work Shop" sessions will comprise of small groups of not more than twenty participants discussing specially selected subjects under the direction of qualified leaders. The Chemical Coatings group will cover legal problems, company communications, cost accounting for small manufacturers, compensation problems of the small manufacturer, and personnel problems. The Trade Sales group will also discuss legal problems and company communications and, in addition, such important topics as color, market research and merchandising, and inventory turn-over will be taken up. Two general subjects— incentive plans and sales quotas, and the selection and training of sales personnel—will also be presented.

Leo Cherne, executive director, Research Institute of America, as well as prominent and govern-

ment speakers, will address this year's annual meeting.

The Roof Coating and Roof Cement Manufacturers' Forum, under the chairmanship of Paul B. Cefalu, has arranged an interesting panel discussion—reducing production and sales costs and developing new products.

In view of the rapid developments taking place within and outside the paint field, it behooves all executives of the paint industry to attend the 71st meeting of the NPVLA in Washington late this month.

## Construction Picture Bright

A MID-YEAR review of construction activity has shown a sharp upturn, according to Edwin W. Maggee, Jr., associate economist of the F. W. Dodge Corp.

For the first three months of this year, contracts for future construction dropped sharply from comparable year-earlier months. January contracts were down 10 per cent, February showed an equal drop. March dipped 12 per cent below a year ago. April surged 4 per cent ahead of April 1957. May set an all-time high for any month on record, and June contracts zoomed 12 per cent above the previous all-time peak set in May.

Two factors accounted for this sharp rise in construction activity:—(1) the surge in residential building during the April-through-June period and (2) the upswing in public construction during the second quarter.

As far as the remaining year is concerned, Mr. Maggee is confident that the second half of 1957 will show enough strength to push the annual totals for 1958 ahead of the record level reached in 1957.

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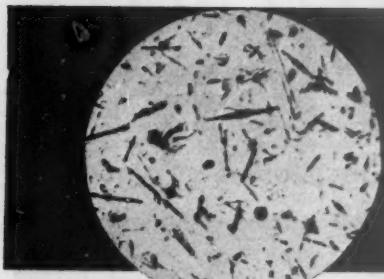
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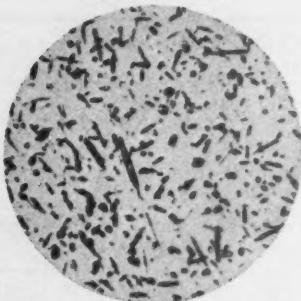
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INTERIOR FLAT with casein			
INTERIOR FLAT without casein			
EXTERIOR PAINT			
PRIMER-SEALER			
WATER-CLEAR FINISH			
COMBINATION INTERIOR-EXTERIOR			

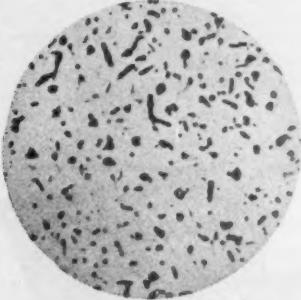
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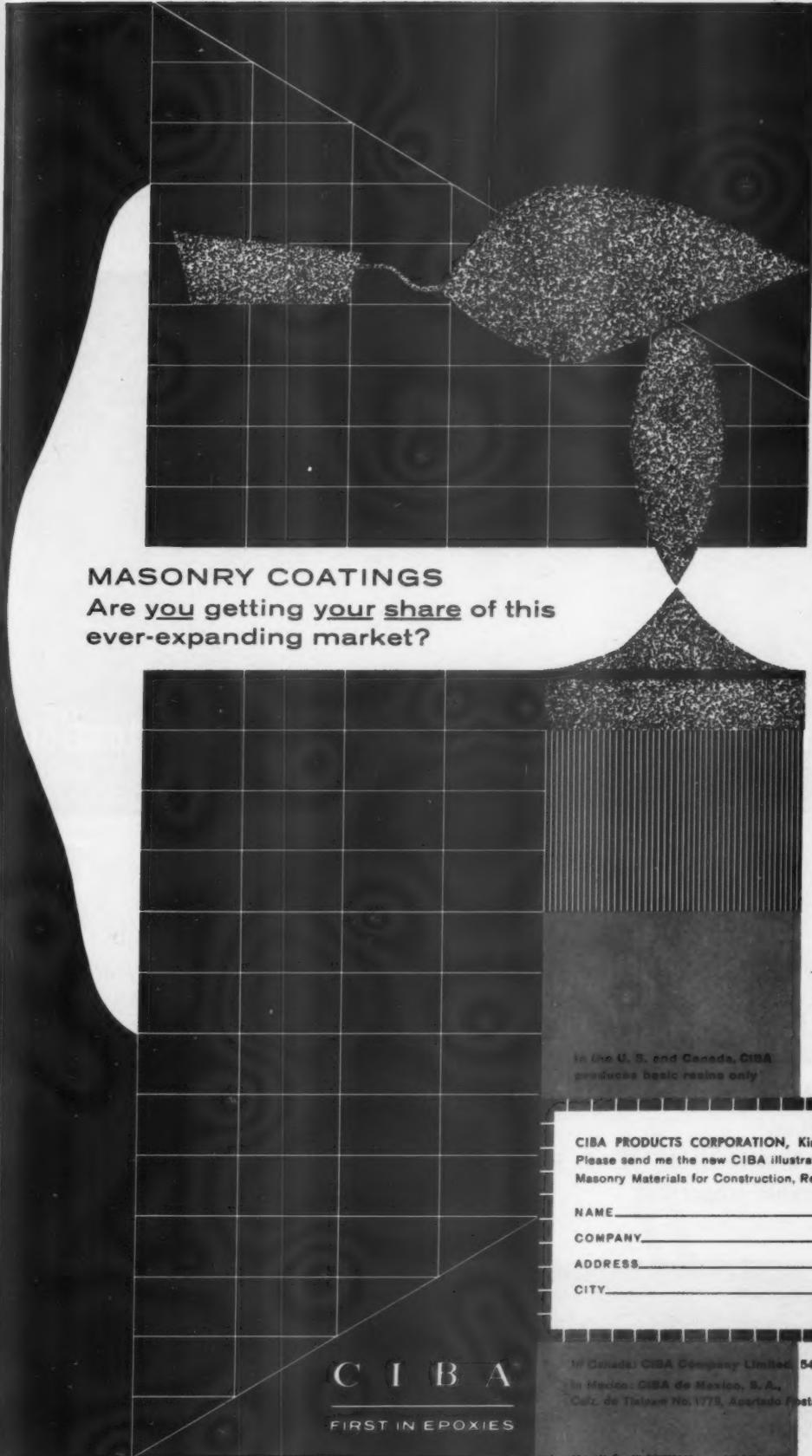
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PvP10-8

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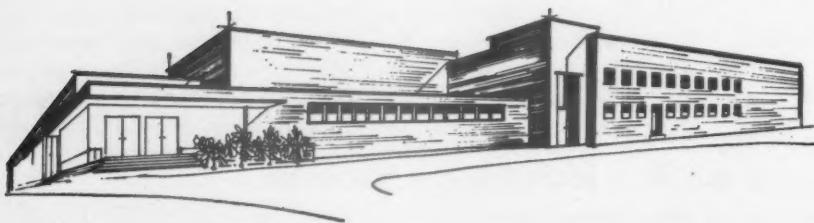
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PVP108

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through a new  
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**PROGRESS IN PIGMENTS**

# IN PIGMENTS

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- "Dalamar" Yellow—new, stable, water-dispersible paste for emulsion paints
- New Technical Service Laboratory and expanded service facilities

This is Du Pont Progress in Pigments—the assurance of new and improved pigments, both today and tomorrow . . . and growing technical skills and resources with which to serve you.

## PIGMENTS DEPARTMENT

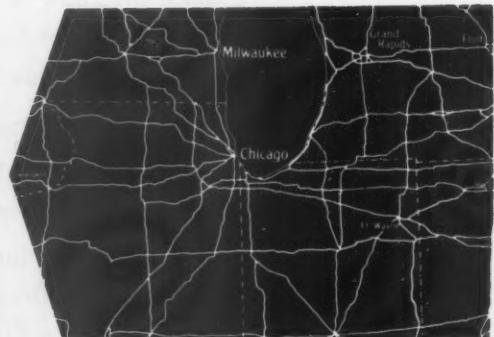


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... FROM DU PONT

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Ask your Eastman representative to show you how use of isobutyl acetate in your formulations can reduce solvent costs, or write to EASTMAN CHEMICAL PRODUCTS, INC., Chemicals Division, KINGSPORT, TENNESSEE.

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is a must!

USE  
**EAGLE-PICHER**  
**20-S Leaded Zinc Oxide**

*costs less and has higher bulking  
value than other low-leaded zinc oxides!*

Laboratory and field tests prove that no other low-leaded zinc oxide can match Eagle-Picher 20-S for high bulking value or for grinding and wetting qualities. Eagle-Picher 20-S is a *twenty* per cent leaded zinc oxide, having as its lead content a basic silicate white lead. You too can prove, as have other manufacturers, that Eagle-Picher 20-S costs less to use than other low-leaded zinc oxides. Compared to other low-leaded zinc oxides, the use of Eagle-Picher 20-S provides a remarkably superior quality paint.

**Physical & Chemical Properties of Eagle-Picher 20-S Leaded Zinc Oxide**

Zinc Oxide .....	80%
Basic Silicate White Lead .....	20%
Particle Size .....	100% 0.5 micron
A.S.T.M. Oil Absorption .....	12.
Specific Gravity .....	5.21
Bulking Value (gal./lb.) .....	.0230
Weight per solid gallon .....	43.50#
Residue +325 .....	0.1



Since 1843

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A N S

at lower cost!

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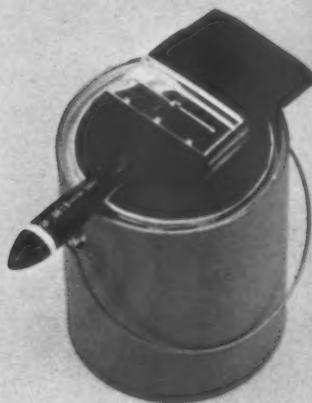
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from



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**BAKELITE Company**

VISIT  
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1958 PAINT INDUSTRIES SHOW / OCT. 5-9 / CLEVELAND, OHIO

**what's new  
from BAKELITE in**

**vinyl latex  
coatings?**



**what's new  
from BAKELITE in**

**product  
finishes?**

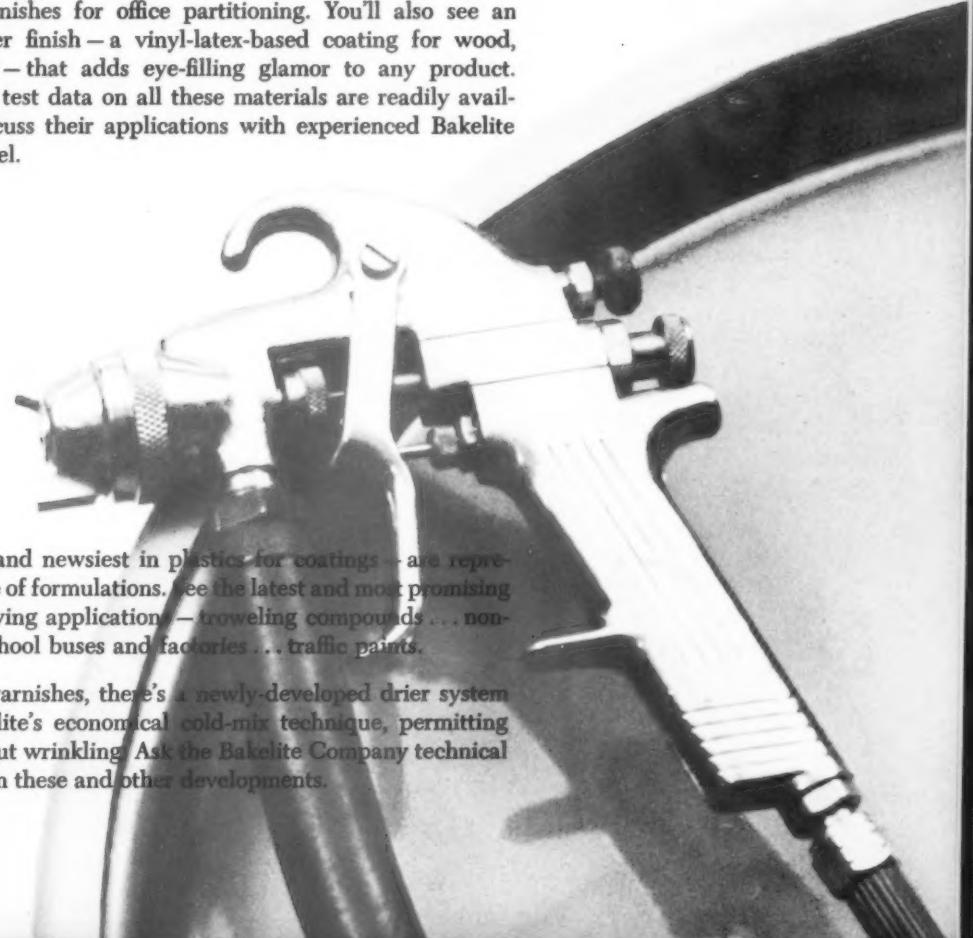
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finishes?**



You'll see a newsmaking formulation using a new vinyl latex for outstanding adhesion to chalky surfaces, backed up by two years of exposure. There's also another full year's service data on WC-130, based on actual use on homes around the country. You will learn about many other plus-advantages of WC-130 in formulating interior paints—including those meeting the requirements of Military Specification TTP-29. There's a wealth of Bakelite Company literature and technical material available to you. Qualified Bakelite Company representatives will help in relating it to your own product demands.

Look for **BAKELITE** Brand Vinyl Dispersion Resins to provide a fascinating variety of effects at surprisingly low cost. Examples are a new "wrinkle finish" development that gives metal surfaces three-dimensional texture with outstanding durability, and organosol post-formable metal finishes for office partitioning. You'll also see an iridescent, hammer finish—a vinyl-latex-based coating for wood, metal, and paper—that adds eye-filling glamor to any product. Formulations and test data on all these materials are readily available. You can discuss their applications with experienced Bakelite Company personnel.



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\*As reported in Official Digest, Paint & Varnish Production Clubs, November 1957  
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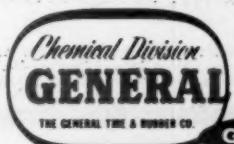
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WITHOUT WRINKLING! WEATHERING DURABILITY  
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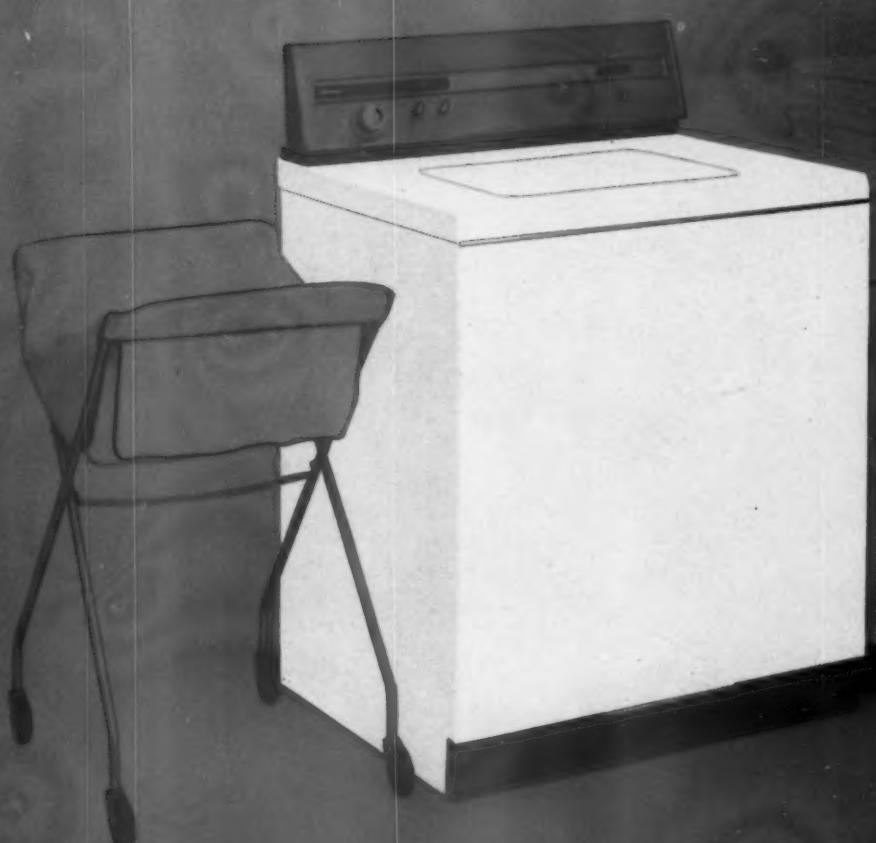
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Appliance finishes that really sparkle need the excellent gloss and color performance provided by Glidden R-11 Zopaque Titanium Dioxide. R-11 Zopaque is the finest low oil absorption grade of titanium dioxide obtainable. What's more, R-11 possesses greatly improved dispersion characteristics, and provides high hiding power, greater whiteness and cleaner tints.

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go on fast and easy*



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IN polyvinyl butyral wash primers, Celite's\* high bulking action and unique particle structure help control hard packing to assure easy application, stability and good performance. Being inert chemically, Celite also provides non-reactivity and compatibility with wash primer pigments. Irregular microscopic Celite particles also promote adhesion of top coats when they are present in primer formulations.

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## **PROBLEM: Odor?**

### **SOLUTION: SOVASOL 35**

This isoparaffinic solvent has such excellent odor characteristics it is setting a high standard for the industry.

## **PROBLEM: Stability?**

### **SOLUTION: SOVASOL 35**

It's color stable and has good storage stability.

## **PROBLEM: Uniformity?**

### **SOLUTION: SOVASOL 35**

Controlled raw material sources, rigid manufacturing standards, exacting finished-product tests, spotless-clean tank car deliveries . . . all add up to uniform, consistent quality performance.

★

For further information about Sovasol 35 and Mobil's complete line of quality aliphatics, call your Mobil representative, or write to address below.

#### **TYPICAL PROPERTIES**

Volatility -	Distillation Range, °F . . . . .	1BP . . . . .	340
	10% . . . . .	352	
	50% . . . . .	360	
	90% . . . . .	371	
	ASTM End Pt. . . . .	405	

Drying Time . . . . . 200 minutes (Toluol,  
20 minutes, under  
same test conditions).

Flash Point, TCC °F . . . . . 120

Solvent Power -	Aniline Point, °F . . . . .	184	
	Kauri Butanol No. . . . .	26	

Weight -	Gravity, °API . . . . .	55.5	
	Gravity, Specific 60/60°F . . . . .	7567	
	Gravity, lbs/gal 60°F . . . . .	6.30	

Purity - Sovasol 35 is water white in color and passes all pertinent stability and copper corrosion tests. It is practically odorless, is doctor sweet and is relatively color stable.

Handling Precautions - Safety - Combustible liquid. Avoid heat or open flame.

Toxicity - Relatively low order of toxicity but avoid prolonged contact with skin or excessive inhalation of vapors. (Further details upon request.)

Shipping Regulations - No ICC Red Label required.



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*speed wetting*

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*reduce surface tension*

*shorten milling time*

*stabilize dispersions*

### NEW TYPES NOW AVAILABLE

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Reflecting their pigmentary properties, these TITANOX products will brighten your processing procedures, too, with their ease of dispersion and uniformity of tint undertone. Titanium Pigment Corporation, 111 Broadway, New York 6, N. Y.; offices and warehouses in principal cities.

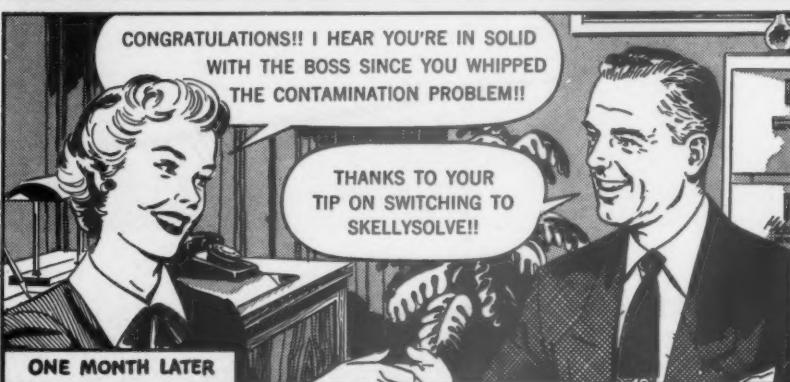
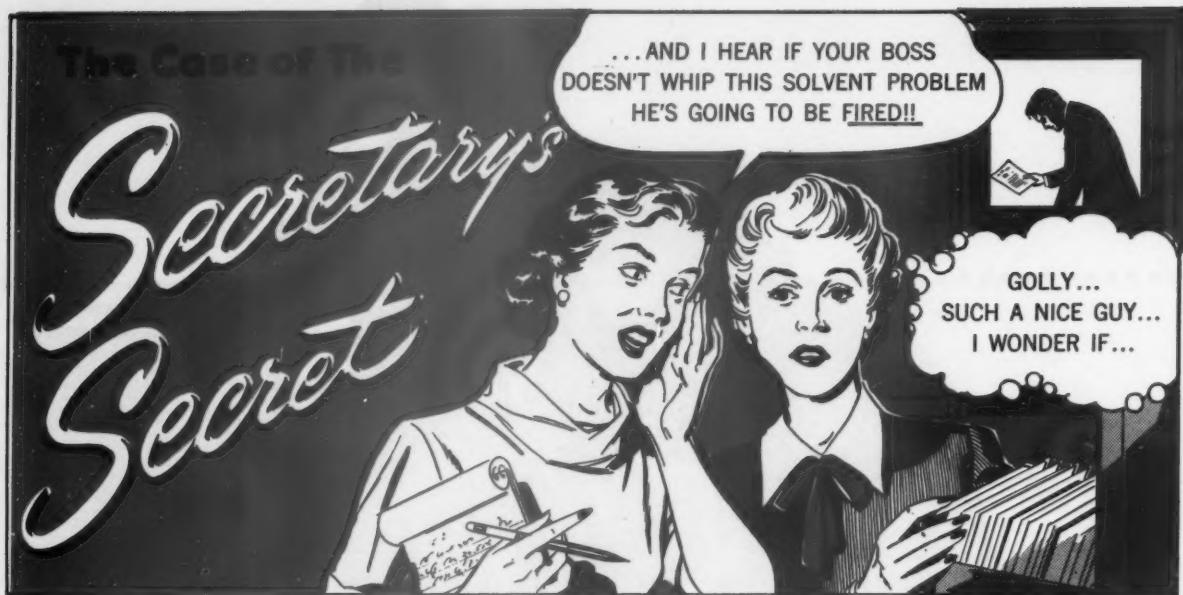
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*Subsidiary of NATIONAL LEAD COMPANY*

\*TITANOX is a registered trademark for the full line of titanium pigments offered by Titanium Pigment Corporation.



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Les Weber  
Manager Skellysolve  
Sales



# Skellysolve

SKELLY OIL COMPANY

Industrial Division

605 West 47th Street, Kansas City 41, Mo.

### Skellysolve for Paint, Varnish and Lacquer Manufacture

**SKELLYSOLVE-L.** A quick-evaporating lacquer diluent of exceptionally sweet odor. Closed cup flash point about 12°F.

**SKELLYSOLVE-S.** Low end point mineral spirits for thinning paints, varnishes, and polishes. Closed cup flash point about 103°F.

**SKELLYSOLVE-S2.** A quick-evaporating mineral spirits. Closed cup flash point about 101°F. Excellent for industrial paints and for polishes and waxes.

**SKELLYSOLVE-V.** Narrow boiling range VM&P naphtha. Excellent for dip and spray enamels. Closed cup flash point about 50°F.

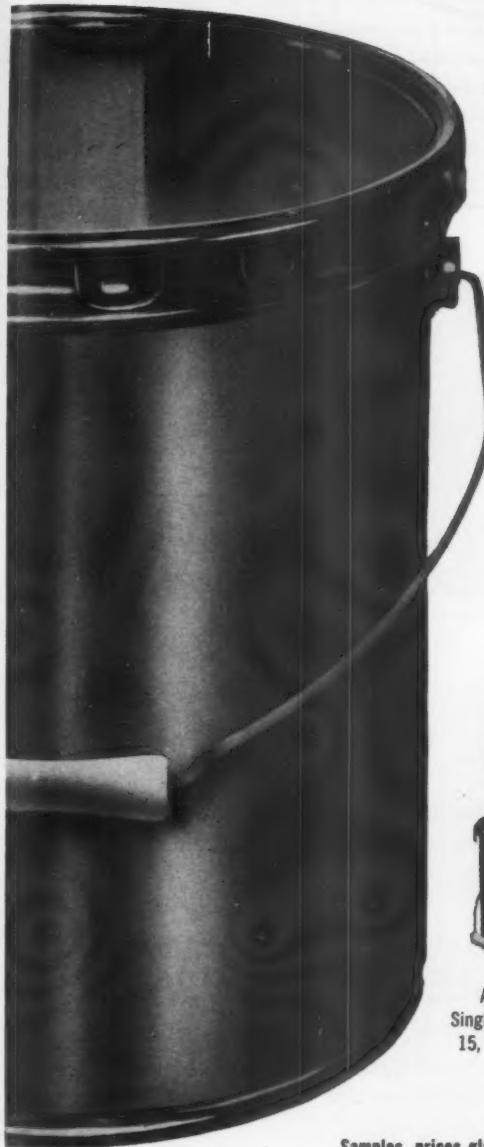
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**SKELLYSOLVE-X.** A heavy, slow drying naphtha having a high flash point. Used to increase the wet edge time, to give better flow and leveling characteristics tending to eliminate brush and lap marks in hot weather.

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Skelly Petroleum Insoluble Grease  
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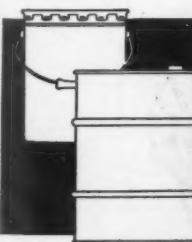
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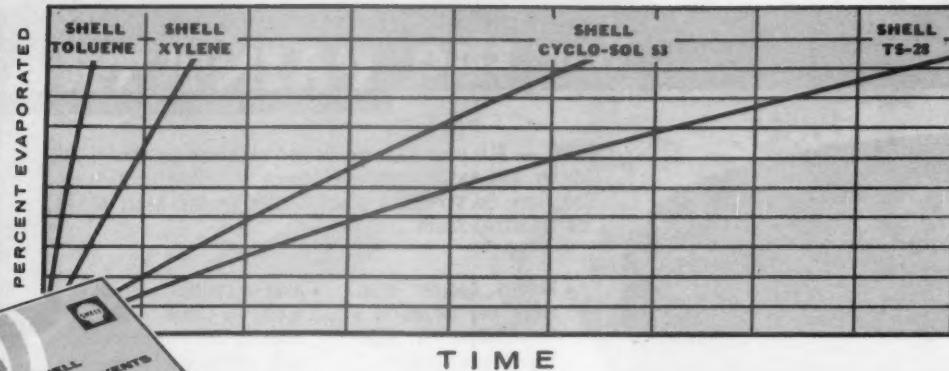


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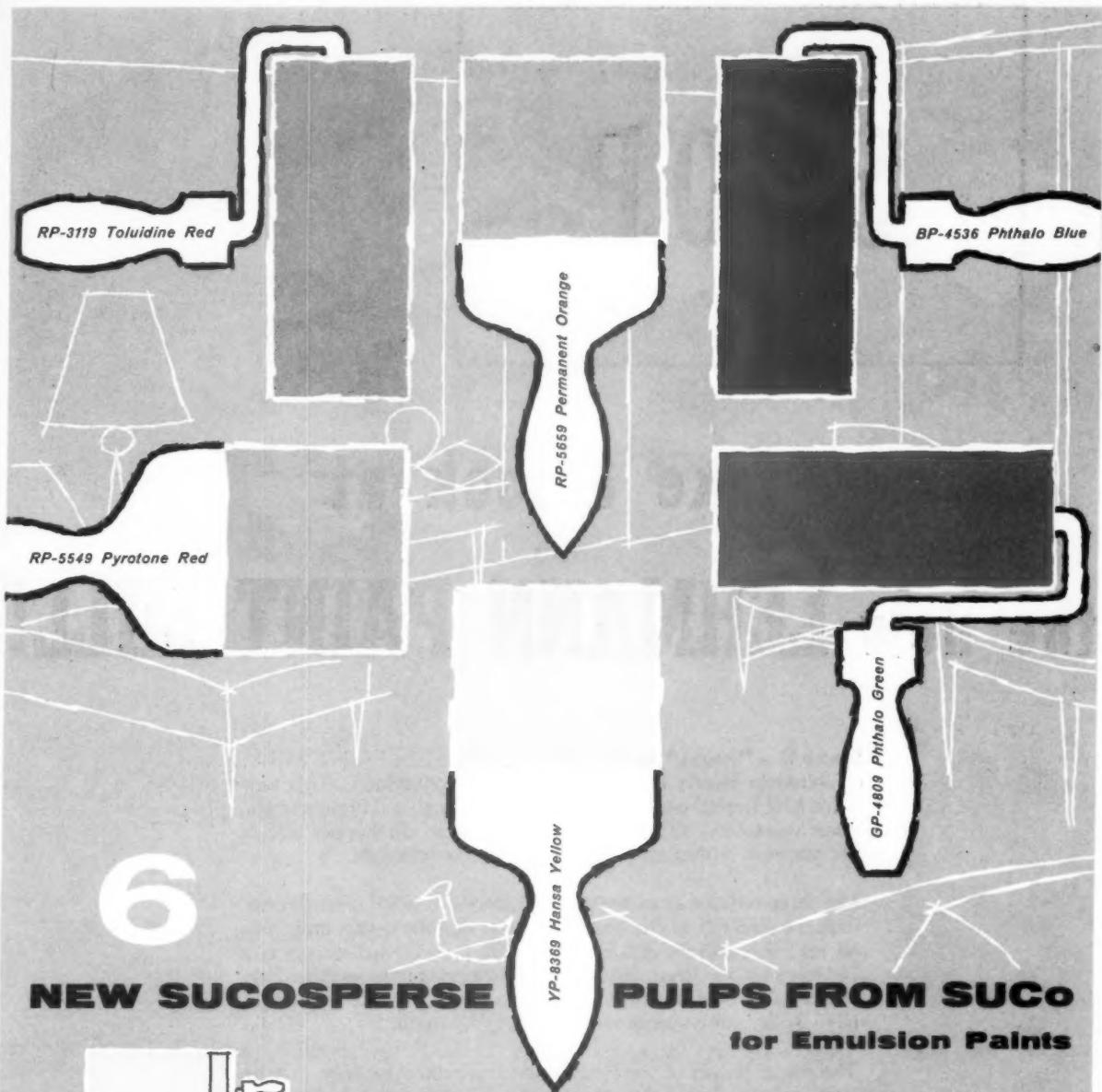
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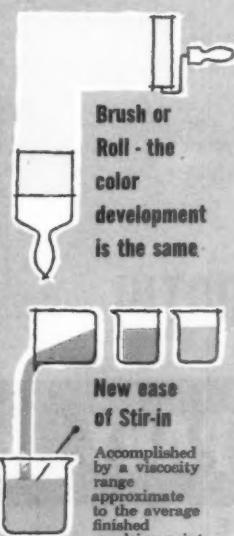
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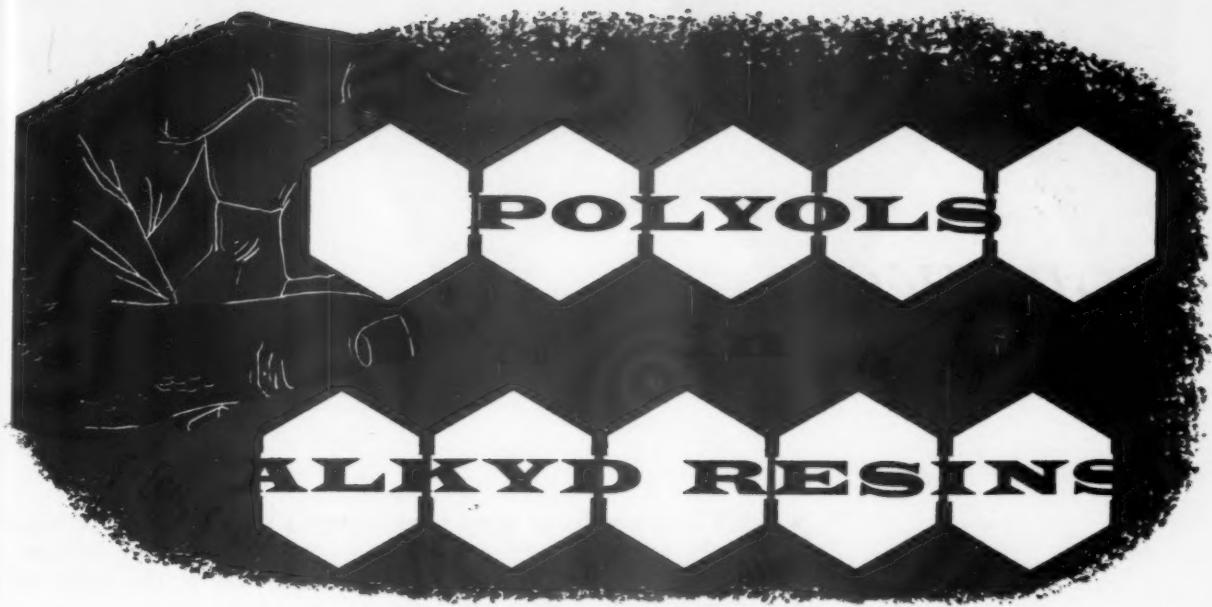
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All opinions expressed in signed articles  
are strictly those of the authors, and do  
not necessarily represent editorial en-  
dorsement by this publication.

# FOREWORD

ALKYD resins have often been referred to as the "work horse" of the paint industry. This term seems appropriate in view of the fact that alkyds constitute almost half of the more than 800 million pounds of resins used in coatings.

In a address before the Spring meeting of the Commercial Chemical Development Association, J. C. Weaver of the Sherwin-Williams Company predicted that alkyds will continue as the major vehicle of the paint industry for some years to come. He further stated that their flexibility in formulation gives such versatility in performance that it will be many years before the host of new polymers based on other systems can crowd them out of coatings uses.

The ingredients that go into alkyd resins are many and varied, making it possible to synthesize "tailor made" resins for practically any application. Within recent years, due to the introduction of new types of polyols, dibasic acids, and modifiers and such recent developments as the "high polymer" technique and new concepts in the alcoholysis reaction, alkyd resin technology has become more complex.

The special features which follow are designed to bring you up to date on the technology that has taken place in polyols for alkyds. Glycerine and pentaerythritol are still the principal polyols used in alkyd manufacture. The newer types, for the most part, are used in conjunction with both glycerine and pentaerythritol to impart special properties to the alkyd.

While the main theme of this feature is polyol usage in alkyd resins, there are discussions concerning the use of polyols in polyester resins, because of the chemical similarity of these two types of resins.

It is our sincere hope that the following series of articles will bring you new ideas as well as new techniques for further investigation in your laboratories. For it is only through the accumulation of technological "know-how" that the paint industry will continue to progress.

ANTHONY ERRICO, *Editor*

# GLYCERINE

By  
N. P. Barr\*

PHRASES such as "glycerine—the 'work-horse' of alkyds" and "glycerine—the 'backbone' of alkyds have on occasion been used to describe the place of glycerine in alkyd resins. Of course, this is quite pretentious, but not without a notable degree of justification. The contribution that glycerine has made to give alkyds their present stature is, even in a conservative sense, endless and certainly without parallel.

Alkyd resins, for all essential purposes, did not assume commercial prominence in the surface coating field until 1927 when R. H. Kienle filed a patent describing the preparation of drying oil-fatty acid modified alkyds for baking and air-drying finishes. Since this historic date in alkyd resin history, the volume output of alkyd resins has risen to over 500 million pounds per year—far and away the major resin type consumed for surface coatings. During 1957, the United States Tariff Commission reported that 540 million pounds of alkyd resins (dry basis) were produced. This output required about 150 million pounds of polyol of which glycerine's contribution is estimated at

between 70 and 80 million pounds, or about 1/3 of glycerine's total consumption (243 million pounds). Thus, alkyds by far constitute glycerine's largest single end use.

Although the history of alkyd resins actually dates back to 1847, none of the initial efforts reached any sustained commercial level of exploitation. After Kienle's work, however, very rapid developments took place. It is particularly significant that by 1930 most of the alkyd making procedures were introduced, but surprisingly very little was known of the nature of alkyds. Even today there is a limited understanding of such basic facets of alkyd technology as 1) reaction kinetics, 2) molecular weight control, 3) molecular weight distribution, 4) effect of polyol functionality. All these variables have a definite effect upon the vehicle formed and consequently upon the resultant film properties.

It is for good reason, however, that the art of alkyd making has advanced so far ahead of the science of alkyd technology. This seems due in large part to the availability of glycerine from the earliest days. Glycerine has given the alkyd maker a polyol of great versatility; versatility in the type of cook;

versatility in the type of vehicle to be made regardless of desired oil length, viscosity and the like; versatility in the infinite variety of coatings, modified or unmodified, which can be formulated from a minimal number of vehicles.

It seems appropriate then, that we first look at the position of glycerine in today's alkyds and then cover, in part, some of the significant advances in alkyd technology which are leading us to a better understanding of reaction kinetics, functionality, molecular weight, and molecular weight distribution.

## Why Use Glycerine?

Glycerine offers many advantages in the manufacture of alkyd resins to fulfill the requirements of today's surface coatings, namely:

1. Ease of handling
2. Allows for flexibility of manufacture
3. Permits versatility in choice of system
4. Superior compatibility and solubility characteristics
5. Product uniformity
6. Imparts excellent film properties.

These advantages go much further than a marginal improvement in

\*Sales Development Department, Shell Chemical Corp.

this film property or that film property, but rather, concrete advantages are realized that are of positive practical benefit during the entire procedure of alkyd resin preparation and utilization. It may be best, therefore, to discuss the advantages of glycerine from the initial receipt of raw materials in a formulator's plant to the final film properties.

Since glycerine is a liquid, the first advantage that is realized by an alkyd manufacture is ease of handling and storage.

Second, glycerine for alkyds allows maximum ease of manufacture. Fusion cooks can be prepared just as easily as formulations prepared by the alcoholysis process. Agglomeration and charring due to local overheating in the kettle do not occur when using glycerine nor is it necessary to resort to burdensome incremental polyol addition as is the case quite often with higher solid polyols. Very close manufacturing control can also be achieved particularly in the alcoholysis step in the production of alkyds made from drying oils. Glycerine has the advantage of giving a very definite end point in the time-honored methanol solubility test. With higher solid polyols, this test is not reliable, and it is generally necessary to devise some special test for alcoholysis completion rather than run the risk of a spoiled batch.

The third major advantage of glycerine lies in its extreme versatility to provide the alkyd producer with any type of desired alkyd. Within the limits of practicability, there is no limitation to a particular oil length; long, medium, or short oil lengths can be prepared—it makes no difference. Further, this versatility allows the alkyd producer to manufacture essentially one multipurpose vehicle from a single polyol, thereby reducing raw material inventory. Such a glycerine-based alkyd vehicle can be used to give air dry finishes, baking finishes, resins for lacquer modification and all the many other applications of alkyd resins. Again, there is wide flexibility.

Next in the line of glycerine advantages are the superior solubility and compatibility characteristics glycerine contributes to alkyds. To obtain special pro-

perties, is it usually necessary to blend several vehicles. The use of glycerine allows the alkyd producer to regulate the branching complexity of the system most economically and surely and, therefore, enhances the solubility and compatibility properties of the resultant alkyd. This advantage also explains the superior pigment wetting properties contributed by glycerine to a wide range of oil length alkyds and resin modified alkyds, and demonstrates once again the broad range of resin properties inherent in a single base like a glycerine alkyd.

The fifth advantage of using glycerine as the polyol is product uniformity. Glycerine contains no related alcohols and can be used with assurance that it will uniformly react in an alkyd formulation as a trihydric alcohol from batch to batch. This is not the case with commercial solid polyols since they are generally a mixture of the polyol and related alcohols which are even higher in functionality. In critical alkyd formulations containing more reactive oils, or a higher phthalic content, any deviation in polyol purity can cause process and stability difficulties. Such difficulties are often further aggravated by the use of combinations of higher solid polyol and glycol in an attempt to achieve the same "average" functionality of glycerine. This practice, however, stands in direct opposition to the idea that a uniform polymer size distribution is desirable in resinous materials for optimum properties. The difunctional glycol would tend to form lower molecular weight materials in the presence of branched complex higher molecular weight reaction products. In fact, this may account for the incorporation of a test for dibasic alcohols in government specification TT-R-266a, Alkyd Resin Solutions. A positive indication of dibasic alcohols disqualifies the product.

A further problem when using higher solid polyols are "seedy" batches, particularly in fusion cooking. This is due to the fact that the solid polyol sometimes sublimes from the batch and on cooling solidifies and contaminates the alkyd with the uncombined solid polyol. Such a condition cannot occur with glycerine.

The sixth major advantage of glycerine in alkyds concerns the specific properties of the resultant film. Since 1927, extensive data have appeared in the literature to substantiate the claims of excellent glycerine alkyd film properties. Bragdon<sup>1,2</sup> has dealt with a wide variety of glycerine alkyd formulations and has indicated such favorable properties as the excellent weather resistance of glycerine alkyds. Park<sup>3</sup> has studied in detail the water resistance of glycerine alkyd resin films. In both the above cases, as in many other alkyd articles published in the past, the use of glycerine has been thoroughly described to give alkyds that exhibit a wide range of desired properties.

The next phase of glycerine alkyds concerns what is presently known about its formation and reaction kinetics, and how these areas of interest are aiding in the practical advancement of alkyd-making.

#### Formation and Kinetics

Up to about 1930, it was generally concluded that esterification was the principle reaction between glycerine and phthalic anhydride and the first stage of the reaction was the almost instantaneous formation of glyceryl hydrogen phthalates of low molecular weights. Later during 1939, Kienle et al.<sup>4</sup> confirmed the predominance of the esterification reaction and proposed the formation of anhydride linkages toward the end of the reaction. It was not until fairly recently, however, that Wekua and Klausch<sup>5</sup> were finally able to determine the order of the reaction with some degree of certainty. They found, in agreement with other investigators, that the greater part of the polyesterification reaction followed second-order kinetics. At degrees of reaction greater than 70-80%, however, Tawn<sup>6</sup> has reported that third-order kinetics are followed.

These fairly recent kinetic theories should further knowledge of activation energies and thus make possible optimum design and control of alkyd resin processes. The theory of functionality is yet another factor which, when properly utilized, will further aid in achieving this goal.

### Theory of Functionality

Many past treatments on functionality theories have generally exhibited a lack of agreement. It was assumed in most cases that all functions of a given kind are equally reactive and undergo a completely random series of reactions amenable to statistical analysis. This assumption does not appear to be completely valid. For instance, in the esterification studies of Feuge, Kraemer and Bailey<sup>7</sup>, it was shown that the reaction between fatty acids and glycerine occurs in two stages of different activation energies, suggesting different reactivities at the  $\alpha$  and  $\beta$  positions of the glycerine molecule. Also Goldsmith<sup>8</sup> has attempted to show differences in the reactivity of the  $\alpha$  and  $\beta$  hydroxyls of glycerine toward the carboxyls of fatty acids, and of the half esters formed by the addition of phthalic anhydride to glycerine. He concluded that the  $\alpha$  hydroxyl reacts more easily with the carboxyl of the phthalic half esters than with that of fatty acid, whereas the  $\beta$  hydroxyl behaves in the reverse way.

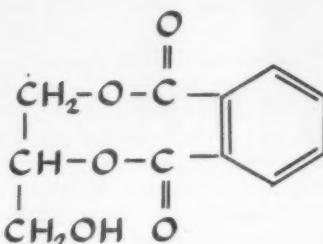
Knowledge of this kind can lead to firm explanations of the intricate structure of alkyd resins and can give reasons why there are apparent differences in the mechanisms of resin formation due to variation of reaction conditions and materials. Some of these differences are illustrated most clearly when alkyds based on several polyols are considered from their molecular weight viewpoint.

### Molecular Weight Considerations

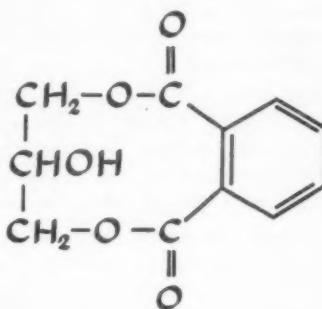
In the study of any polymeric substance, one of the most important variables is its molecular weight. This value, which can be dependably measured by Debye's<sup>9</sup> light scattering technique, has a pronounced effect on the viscosity and ultimate film properties. The longer the resin molecules, the harder and tougher are the films such resins produce.

Alkyd resins made with glycerine form the longest molecules; even longer than alkyds made with polyols of higher functionality because with glycerine there is less likelihood of ring formation. While it is possible to draw 8-membered and 9-membered rings between glycerine and phthalic anhydride,

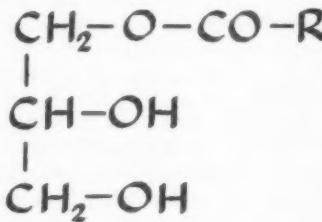
only 9-membered ones have a small but definite chance of forming according to Carothers<sup>10</sup>. Thus,



does not exist but 9-membered cyclic esters are possible:



However, even the 9-membered rings in the case of glycerine alkyds are quite rare since one of the primary (or  $\alpha$ ) positions of the glycerine molecule is blocked by a fatty acid. Thus,



cannot participate in forming a cyclic ester with phthalic anhydride. This has been shown previously that the fatty acid

ester of glycerine in the secondary (or  $\beta$ ) position is definitely not favored and transesterifies to the  $\alpha$  position at an extremely rapid rate. Therefore, the first formation between a fatty acid and glycerine is such as to minimize any ring formation.

It is curious to note that this is not the case with pentaerythritol or other polyols such as trimethylolethane and trimethylolpropane. Since all the hydroxyl groups of these polyols are primary, the fatty acid reacts equally rapidly and permanently with any of the hydroxyl groups. As long as any two adjacent hydroxyl groups are left unreacted, a 9-membered cyclic ester can easily be formed, as shown in Figure 1.

The above cyclic ester considerations also show that the effective functionality of glycerine in relation to other polyols for alkyd resins is actually higher than appears from straight structural comparisons. It is also shown that the presence of a secondary hydroxyl group in the case of glycerine is a distinct advantage in alkyd resin formulation. If it wasn't for the secondary (or  $\beta$ ) hydroxyl group, a fatty acid could form an ester with glycerine in any position and thus greatly increase the possibility of ring formation. Since glycerine has such an extremely small chance of forming cyclic esters, its molecules have a more uniform structure and are longer than those compared even to systems using polyols of higher functionality, and therefore, result in harder and tougher films, superior in practically every conceivable test<sup>11</sup>.

### Molecular Weight Distribution

A further reason behind the superior properties of glycerine

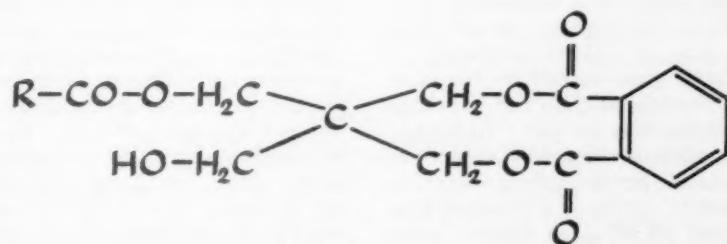


Figure 1.

alkyds concerns its molecular weight distribution and how it can be controlled. This factor has been shown on many occasions to greatly effect the alkyd's physical and chemical characteristics. Investigators<sup>12</sup> have demonstrated that upon separation of various fractions of an alkyd resin there appeared at two extremes a hard-drying short-oil fraction and a slow-drying longer oil fraction. These fractions exhibited definite differences in composition and molecular weights primarily due to the differences in the degree of reaction.

Ideally, it would be desired to be able to control the alkyd cooking process to provide the highest concentration of the desired molecular weight level in the polymer. This was in part accomplished by Wilson and Robson<sup>13</sup>, who showed that increased quantities of high polymer in the alkyd product can be obtained by a specially controlled alcoholysis process using a high free glycerine content at the time of the phthalic anhydride addition, resulting in a paint with improved properties.

This field of technological study seems most likely to provide the tools and knowledge that may allow the formulation of alkyd resins that consistently exhibit improved paint properties. Many steps are already being taken toward controlling the molecular weight level of alkyd resins. It can be expected that such efforts will in time also enable an alkyd producer to realize pinpoint formulating to match desired properties with a minimum of experiment.

### Glycerine Alkyd Modifications

An essential advantage of glycerine in alkyd resins lies in its ability to provide systems that are highly compatible with the widest range of modifiers. Such modifiers, chosen to give the resultant alkyd resins specialized properties, are used quite often in today's alkyd resins. To improve the dry rate, styrene is added according to several procedures<sup>14</sup> to the basic polyhydric alcohol and polybasic acid reaction product. To produce alkyds with improved solvent resistance, acrylonitrile is sometimes used to modify a styrenated glycerine alkyd. Of course, rosin, vinyl resins, phenol-formaldehyde resins, and urea-formaldehyde res-

ins in addition to the many well-known oils and their fatty acids have been used for many years to modify glycerine alkyds with no accompanying compatibility problems.

Another specialized coating system to meet specific requirements is a silicone modified alkyd resin. Such an alkyd based on glycerine has been used successfully to improve heat resistance. Other modifiers include di- or polyisocyanates, vinyltoluene-divinylbenzene, and p-tert-butyl benzoic acid which improves the drying time, color, gloss, chemical and soap resistance. In each case, these systems are compatible and can be easily reproduced when the base alkyd is a glycerine alkyd.

Epoxy resins have also been used as modifying agents in glycerine alkyds to produce systems that take advantage of the many superior properties of epoxy resins<sup>15</sup>.

The all-round advantages of glycerine in alkyds are further illustrated by its complete adaptability to any polybasic acid. Most prominent of late is isophthalic acid, where glycerine's role has been found to provide alkyds that exhibit unique strength and toughness. In the case of other polybasic acids such as maleic anhydride, fumaric acid, adipic acid, pyromellitic acid, and chlorendic acid, glycerine can be used with confidence.

### Summary

Glycerine continues to be the predominant polyol in alkyds for a host of reasons. Maximum alkyd manufacturing flexibility is achieved by its use because of its extreme versatility. Long or short oil alkyds can be produced as well as the formulation of endless numbers of copolymers with the greatest variety of modifiers. These systems exhibit superior stability, compatibility and have better clarity. There is minimum danger of "seeding" or color control during manufacture. There is minimum danger of reduced compatibility of resins with lesser oil length. There is minimum danger of gelation since the cooking of glycerine alkyd resins can be easily controlled. Batch after batch of glycerine-based alkyds can be consistently reproduced within man-

ufacturing limits because the use of glycerine promotes a more uniform resinous structure.

The technology of alkyd resins is slowly advancing to the stage whereby it may soon be possible to calculate bodying rates, gel points, deduce molecular weight distributions, and relate molecular weight and molecular weight distribution to solution viscosity and to behavior during evaporation and drying. Thus, with a minimum amount of experimentation, some desirable but heretofore elusive combination of properties may be realized. It is here where the most important but least spectacular advances in alkyd resins are being made.

A greater understanding of the mechanism of film formation is continually moving forward so that a better picture of the structure of these resins can be provided. Yet, in actual facts, we still know comparatively little as to what happens between the acid and alcohol components of alkyds, and how to intentionally produce a specific molecular weight distribution of a particular resin composition. Undoubtedly, new preparation techniques and new evaluation procedures will be the result of forthcoming technological advances. Through the experience of the past, we are assured that in the future glycerine will continue to be the standard polyol in these alkyd advances.

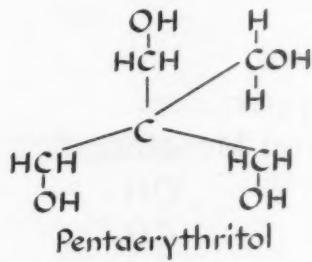
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# PENTAERYTHRITOL

By  
Charles L. P. Vaughan\*

PENTAERYTHRITOL, commonly called PE, is the name assigned to the tetrahydric alcohol prepared by Tollens and Wigand in the late eighteen hundreds by condensing acetaldehyde with formaldehyde.<sup>1</sup> The prefix "penta" signifies the presence of five carbon atoms in the compound



and "erythritol" shows its similarity to the four-carbon tetrahydric alcohol:



Only since the 1930's, however, has it been available in commercial quantities, starting out as the purified, recrystallized grade for the manufacture of the high explosive pentaerythritol tetranitrate (PETN).

Even before the 30's, consider-

able interest had been shown in the possible uses for PE. Research on nitration to produce explosives and on the synthesis of resins and oxidizing oils for coatings had been extensively pursued. Hercules, for example, pioneered during the 1920's in a study of rosin esters from pentaerythritol resulting in the basic U. S. patent #1,820,265, issued in 1931, which was subsequently dedicated to the public.

By the end of 1930's, technical grade PE—a white, free-flowing powder eminently suited for all but nitration uses—made its appearance at a price to fit the economics of the resin and oil market. From that time, the growth in use of pentaerythritol has shown constant acceleration.

Much, if not most, of this growth came in the field of protective coatings. In the opinion of many alkyd technologists, the use of PE in phthalic alkyds represents one of the most important advances

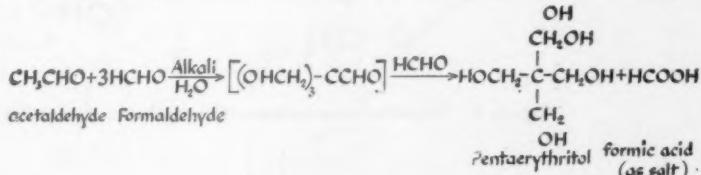
in alkyd technology since the introduction of the original phthalic glyceride resin.

Today there are seven producers of PE in this country with an operating capacity of about 120 million pounds annually. This increased productive capacity, making for assured supply in excess of current demands, is an added stimulus to encourage promising new developments for the use of pentaerythritol.

#### Manufacture of PE

Pentaerythritol is manufactured by condensing acetaldehyde with formaldehyde in an aqueous alkaline medium as shown by Equation A.

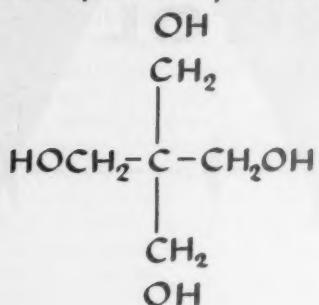
PE forms rapidly through the trihydroxy aldehyde intermediate called pentaerythrose. Evidence of the existence of this compound has been observed in polarographic studies, although the compound itself is difficult to isolate because of



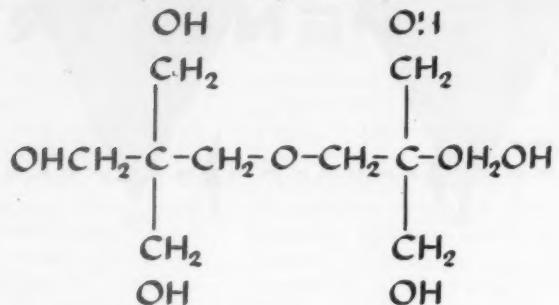
Equation A

\*Technical Representative, Synthetics Department, Hercules Powder Co., Wilmington, Del.

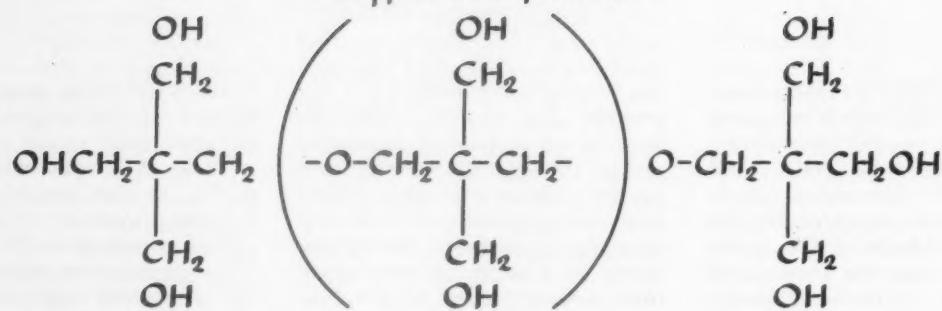
**I-4 Heteropolymer**  
**Monopentaerythritol**



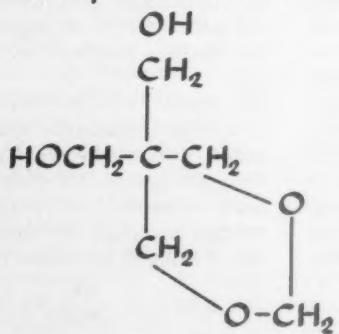
**2-8 Heteropolymer**  
**Dipentaerythritol**



**N-4N Heteropolymer**  
**Polypentaerythritol**



**I-5 Heteropolymer**  
**Pentaerythritol Monoformal**



**2-9 Heteropolymer**  
**Bispentaerythritol Monoformal**

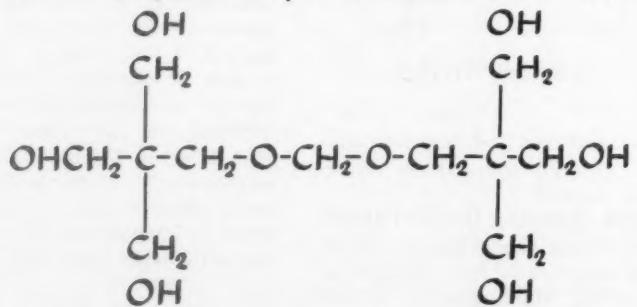


Figure 1. Some heterocondensation products of acetaldehyde and formaldehyde.

its reactivity with other aldehydes in the reaction mixture.

In practice, the raw material requirements are greater than shown by this equation. This is due to the many by-products that can be formed during the reaction. Varying proportions of homocondensation products of acetaldehyde, and of formaldehyde, may be found in the reaction as well as the many heterocondensation products involving both of the raw materials. Some of these heterocondensation products are shown in Figure 1. The ratio of reactants and reaction conditions control to a large extent the amount of those compounds formed in a given reaction mixture. These compounds may be isolated either singly or as mixtures by evaporation, fractional crystallization, or solvent extraction. An example of one such mixture is technical PE which contains primarily mono- and some dipentaerythritol.

It is customary to use a series of evaporation and fractional crystallizations to isolate the desired product from the crude reaction mix-

ture. This is necessary because maximum performance properties from any grade of PE can only be obtained by reducing or eliminating undesirable organic and inorganic impurities. If this is not carefully done, the residual impurities can lead to the formation of dark-colored vehicles with poor performance properties.<sup>2,4</sup>

The equipment used in the isolation and purification steps accounts for the major portion of the investment in a PE plant. During these steps, rigid control of conditions is needed to produce high yields of a quality product. The chemistry of pentaerythritol and its use in commercial production are the subject of several patents<sup>5-12</sup> and publications.<sup>13-14</sup>

Major advances have been made in upgrading the quality of PE over the last few years. These are the result of extensive research and process development work as well as the application of modern process control methods, particularly plant instrumentation. The new PE plant constructed by Hercules in Louisiana, Missouri incorporates

the most recent technical and mechanical advances in the production of PE. This plant is an integrated operation using formaldehyde made on the plant site from the dehydrogenation of methanol, which in turn is produced from natural gas and steam (see Figure 2). The methanol, formaldehyde, and PE plants are each operated from central control stations. Figure 3 shows the control room in the PE plant.

#### Use of PE in Alkyd Vehicles

The major portion of PE sold in this country is used in the production of oil-modified alkyd vehicles, are usually classified according to the type and amount of oil modification. Most commercial vehicles are long- to medium-oil oxidizing types or medium- to short-oil nonoxidizing types. The former are primarily formulated into trade sales or shelf goods for use in the home where they are applied by brush or roller. The short-oil, nondrying types are made into industrial vehicles which are applied by dipping, spraying, roller

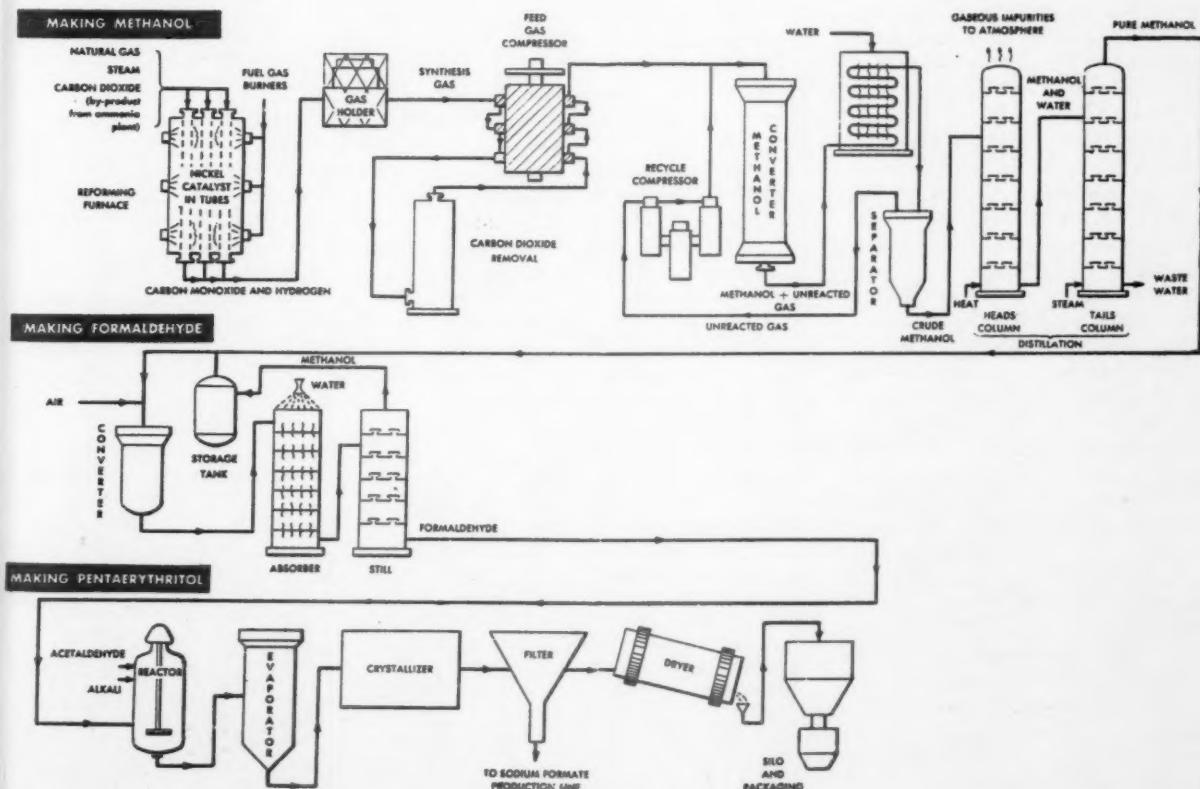


Figure 2. Manufacture of pentaerythritol from natural gas and acetaldehyde at the Hercules Louisiana, Missouri plant.



Figure 3. Control room in the Hercules pentaerythritol plant at Louisiana Missouri.

coating, etc. There has been a continual increase in the use of PE in alkyds to a point where it now supplies about one-half of the total polyols used in the manufacture of resins. Alkyd producers have accepted PE because they have been able to obtain an economic combination of performance properties not obtainable with other polyols.

The long and medium oil length oxidizing alkyd vehicles consume better than 60% of the PE used in alkyds. Typically, the use of PE in these alkyds gives better brushability, excellent color stability on exposure to either heat or light, and improvements in drying properties, gloss retention, humidity resistance, and weather resistance. These important advantages inherent in the use of pentaerythritol can be attributed largely to its molecular structure and its functionality, the latter including both the number and the type of reactive chemical groups. Good advantage is taken of these properties in formulating satisfactory alkyds of longer oil length than is possible with glycerin alone. Alkyds I and II of Table I show a comparison of soybean fatty acid modified vehicles having similar viscosities. The PE alkyd (Alkyd I) has 7.3% more fatty acid modifier than does the glycerin alkyd (Alkyd II). If the oil length of the glycerin alkyd were increased to be the same as the PE

alkyd, this vehicle would have a lower viscosity, inferior drying characteristics, and would produce a softer film with poorer water resistance and durability. One way commonly used in which the properties of the glycerin alkyd can be improved to a satisfactory level is to increase the functionality by incorporating a maleic modifier as shown by Alkyd III. However, this type of modification must be done with discretion, otherwise, vehicles with poor brushing qualities and inferior can stability result. Alkyd IV exemplifies a more economical approach that may be used to achieve the functionality of glycerin—that is the use of PE and ethylene glycol. Here, as with glycerin, the maleic modification is necessary to obtain the proper over-

all properties.<sup>15</sup> These four vehicles have been evaluated in unpigmented films and were comparable in all respects with the exception of drying rate and film hardness where the straight PE alkyd (Alkyd I) had an advantage.<sup>ii</sup> Panels of pigmented enamels containing Alkyd III and Alkyd IV were exposed in Florida for 15 months. The stability obtainable through the use of PE was shown markedly by the better gloss retention and resistance to dirt pick-up of the enamel containing the PE-glycol alkyd throughout the duration of the test.<sup>16</sup> Related vehicles can be made by alcoholizing triglyceride oils. A study of this alcoholysis reaction with PE has been made in our laboratory.<sup>17,18</sup>

A major development in current alkyd technology is a sharp increase in availability of low-cost, highly refined tall oil fatty acids. Pentaerythritol is being used extensively with both low and high rosin content tall oil fatty acids in alkyd vehicles for trade sales and industrial finishes. With these semi-drying acids, the tetra functionality of PE is necessary for those vehicles which require rapid air-drying characteristics such as trade sales architectural enamels.

Pentaerythritol has not been used as extensively in short-oil nonoxidizing vehicles as it has in long-oil vehicles. Here the higher functionality of PE presents gelation problems when employing the usual formulating technique. For example, the shortest satisfactory PE-phthalic alkyd modified with coconut fatty acids we have been able to prepare in large scale plant equipment with a maximum acid

	I PE Alkyd	II Glycerin Alkyd	III Modified Glycerin Alkyd	IV Modified PE-Ethylene Glycol Alkyd
Phthalic Anhydride	148	148	129	129
Maleic Anhydride	—	—	12	12
Soybean Fatty Acids	350	248	350	350
Technical PE	125	—	—	83.5
Glycerin, 98%	—	98.8	112	—
Ethylene Glycol	—	—	—	37
Acid Number	10	6.0	3	8.4
Viscosity				
60% Solids in M.S.*	V-W	R	R-S	U-V
Fatty Acid, %**	61.1	53.8	62.1	61.3

\*M. S.—mineral spirits, Gardner Holdt Viscosity

\*\*Calculated fatty acid content in the finished product.

Table I. All vehicles having comparable viscosity at 60% solids.

number of ten contains not less than 50% coconut fatty acids. However, it is possible to produce PE alkyds containing lesser amounts of modifier and with desired performance properties by (a) using lower molecular weight aliphatic monobasic modifiers such as pelargonic or caprylic acid, (b) adding small amounts of aromatic monobasic acid such as benzoic acid, (c) reducing the average functionality of PE with a glycol, or (d) a combination of these three techniques. Examples given in Table II show the application of these principles in the design of vehicles for use with melamine-formaldehyde resins. Performance properties such as greater hardness, improved water resistance, better gloss and color retention, particularly at elevated temperatures, and durability can be observed as a result of these formulations. Each of these techniques may be used to produce vehicles with excellent performance properties in one-coat appliance finishes,<sup>19</sup> automotive enamels,<sup>20</sup> and nitrocellulose lacquer plasticizing alkyds.<sup>21</sup>

By employing these principles, alkyd formulators are able to capitalize on the technical and economic merits of PE for application in short-oil, nonoxidizing vehicles. For instance, the water resistance in a nitrocellulose lacquer application can be markedly improved as shown in Figure 4 by using PE and ethylene glycol instead of glycerin. Both these pigmented, short, oil alkyd vehicles contain the same amount of lauric acid modification.

#### PE for Resins

Another large market is in the esterification of PE with rosin and related resin acids. Here full ad-

Composition and Properties	I	II	III	IV
Lauric Acid	257	—	—	—
Pelargonic Acid	—	200	150	80
Benzoic Acid	—	—	38.1	—
Phthalic Anhydride	145	146	146	150.3
Fumaric Acid	2.84	2	2	—
Technical PE	148	148	148	71.9
Ethylene Glycol	—	—	—	40.2
Solid Acid Number	5.3	6.5	4.9	4.6
Solution Constants				
Solids, %	60	60	50	50
Viscosity in Xylene*	T	V-W	U	U
Color (Gardner 1933)	1-2	1-2	1-2	1
Fatty Acids, %**	50.1	43.8	33.8	25.4

\*Gardner Holdt.

\*\*Calculated fatty acid content in finished product.

Table II. Short oil non-oxidizing alkyds containing pentaerythritol.

vantage is taken of the higher functionality and the configuration of the PE molecule to produce higher melting resins having less modification at faster processing times. The upgraded performance provided by PE resins has become an industry standard. Specific benefits include better drying time, improved stability, greater water resistance, and in many cases, improved compatibility due to the lower modification needed to obtain the necessary properties.

These resins have found widespread usage in the protective coatings industry in flat wall finishes, decorative enamels, floor finishes, and exterior enamels. They have also proved outstanding for use in printing inks, adhesives, and floor coverings.

#### PE for Plasticizers

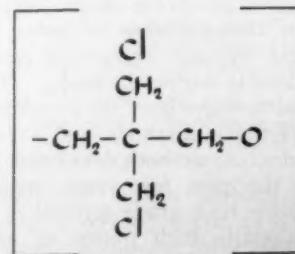
Plasticizers based on PE are benefited by its stable structure. It imparts to the plasticized composition marked improvements in age-life and in stability to both heat and light. Thermal stability at elevated temperatures is excellent, and better compounds for

many electrical applications have reached commercial significance because of this.

#### New Uses for PE

There are several examples of PE and pentaerythritol derivatives which are undergoing commercial development in fields other than coatings. Pentaerythritol is being used in conjunction with metal salts such as tin laurate to stabilize vinyl copolymers against attack by heat and light.<sup>22</sup> It is also finding use in intumescent paint formulations because it is a high melting, crystalline compound which decomposes slowly when the paint film is exposed to an open flame.

Pentaerythritol is the raw material for Penton<sup>†23</sup>, a new polymeric material which is being used in molded plastics. It has found many applications because of its outstanding ability to withstand high humidities, high temperatures, and attack by many chemicals. Penton is readily molded into complex shapes. The repeating unit in the polymer is:



#### General Advantages

All of the PE-containing materials mentioned above have outstanding (Turn to page 160)

<sup>†</sup>A registered trademark of Hercules Powder Company.

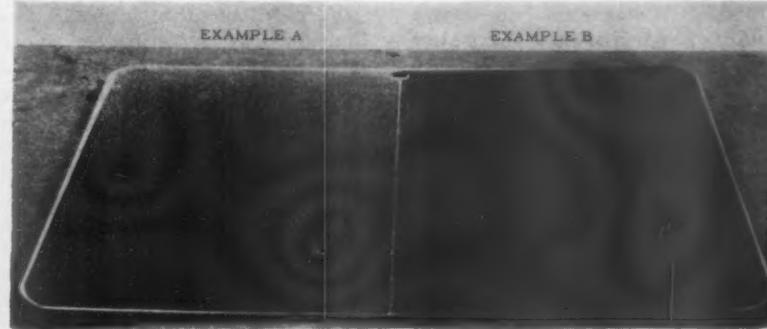


Figure 4. Water resistance of nitrocellulose lacquers after 24 hours at 100 deg. F. and 100% R. H.



By  
J. P. Burns\*

SINCE its first appearance in the U. S. in commercial quantities, about twenty years ago, sorbitol has interested resin technologists as a possible ingredient in low-cost vehicles for protective and decorative coatings. Recent developments in sorbitol manufacturing and purification techniques have given increased impetus to its usage.

The chemical structure of sorbitol and its relationship to glycerine and pentaerythritol immediately suggest the possibilities of sorbitol for use in alkyd resins, ester gums, and drying oils. Early resin experiments with sorbitol were disappointing in some respects because impurities caused darkening during the cook. These disadvantages have been overcome by refining methods and volume production methods developed during the past few years, making possible resin-grade sorbitol of exceptionally high purity at lower and lower prices. Sales volume to the resin industry has increased steadily and high-purity sorbitol is being re-evaluated widely throughout the coatings industry for many purposes.

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Chemically, sorbitol,  $C_6H_{12}O_6$ , is a hexahydric member of the polyol family, glycerine being the classical trihydric member and pentaerythritol the most important tetrahydric member. Atlas makes sorbitol by continuous catalytic hydrogenation of glucose and markets it as a white powder or pelleted solid and as a colorless 70% aqueous solution.

Prime markets for the product are in candy, cosmetics and pharmaceutical products, where purity is essential, and commercial sorbitol production is in the tens of millions of pounds annually. A special "resin grade" product of low reducing sugar content is available. Usage by the coatings industry is therefore no longer limited to cheaper dark resins, but is rapidly extending to high-quality coating vehicles for clear or white and light-colored pigmented products.

#### Alkyd Resins

Alkyd resins comprise an important and large portion of the total paint vehicle market. Alkyd resins are basically polymeric esters prepared by the condensation of a polyhydric alcohol and a polybasic acid.

Sorbitol, since it is a polyhydric alcohol, has been shown to be an important raw material for alkyd resin production. Sorbitol is particularly suitable for the preparation of alkyds characterized by excellent drying rates, film flexibility, film gloss, resin compatibility and shelf life.

In alkyd resin processing at the high temperatures required for alcoholysis and/or esterification, sorbitol is unique in that it has a tendency to split off water to form form inner ethers intramolecularly. These inner ether structures contribute a polarity to the molecule that is transferred to the resins and valuable superior properties of adhesion and compatibility result.

Because of the internal anhydridization resulting in inner formation which occurs with sorbitol at high temperatures the number of hydroxyl groups available for esterification is less than the theoretical six. Steric hindrance due to this internal ether formation frequently makes it difficult to obtain low acid number products when using sorbitol as the sole polyol. For this reason it has been found advantageous to use an auxiliary polyol with sorbitol in alkyd resin synthesis.

Alkyd resins made from glycerine-sorbitol combinations dry faster and have tougher, harder films than those of all-glycerine alkyds, at no sacrifice of flexibility or adhesion.

Alkyds made from pentaerythritol-sorbitol combinations produce films which approach the drying speed of an all-pentaerythritol alkyd film with added improvement in resin compatibility, flexibility and adhesion.

Creselius<sup>1</sup> tested various alkyds in combination with vinyl resins for ship topside coatings. He reported favorable results with glycerine-sorbitol based alkyds.

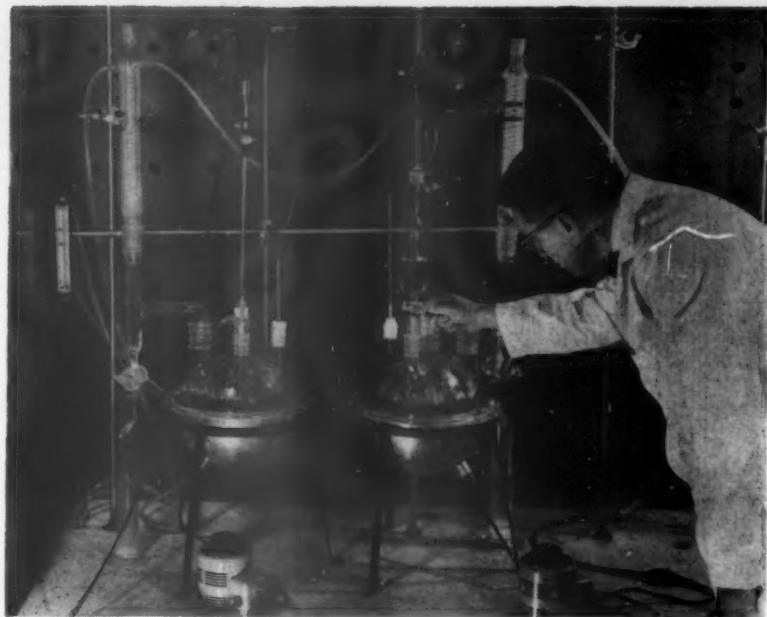
In the processing of alkyd resins using sorbitol or sorbitol combinations with other polyols the standard generalizations regarding optimum reaction conditions have been established.

In general, the processing techniques normally used in efficient alkyd resin manufacture are applicable to sorbitol-based resins. Excellent coverage of this subject is given in reference<sup>2</sup>.

We have found that azeotropic distillation is far superior to fusion cooking in that reaction rates are materially increased and better reaction control is realized. Consequently, processing time is saved and improved resin color invariably results when using azeotropic distillation methods.

In oil modified alkyds, where alcoholysis is first carried out, catalysts of the type exemplified by litharge, lithium hydroxide, or certain metal naphthenates are satisfactory. Concentrations of alcoholysis catalysts vary from 0.01% to 0.15%, based on the amount of polyol used in the alcoholysis reaction. Alcoholysis reaction temperatures follow well-known routes, lower temperatures (200-215°C) increase alcoholysis time while higher temperatures (245-260°C) decrease alcoholysis time. High temperatures, however, have a tendency to increase colors so that the recommended temperature is about 240°C.

The use of an inert gas blanket or sparging with an inert gas is highly recommended in any type of alkyd cook and an adequate agitation rate is essential.



Regulating the flow rate of sorbitol in preparation of sorbitol alkyd at Atlas Central Research Laboratory in Wilmington, Del.

**Short Oil Length Alkyds:** Sorbitol is most advantageous in short oil alkyds. Sorbitol-glycerine combinations appear to give the best short oil alkyds.

Experimental data<sup>3</sup> indicates that in comparing sorbitol-glycerine short oil alkyds with all-glycerine alkyds:

- 1 - Some properties of alkyd resins such as viscosity, mineral spirits tolerance, and film properties vary with phthalic content. It has been shown that sorbitol-glycerine alkyds can be made to match or surpass glycerine-alkyds in any one of such properties by proper adjustment of the phthalic content.
- 2 - Colors of 50% mineral spirits solutions of sorbitol-glycerine short oil alkyds are very slightly higher than those of all-glycerine alkyds (5-7 compared to 4-6 on the Gardner scale). Both types are satisfactory for white finishes.
- 3 - 50-50 sorbitol-glycerine alkyds give baked films superior in Sward Rocker Hardness to all-glycerine alkyds of similar phthalic content.
- 4 - In numerous other properties both with clear and

pigmented films sorbitol-glycerine alkyds appear to be equal to or somewhat superior to those of all-glycerine alkyds.

A typical short oil length sorbitol-containing alkyd formulation is given in Table I.

Table I

Soya Oil	372 pts. by wt.
Phthalic Anhydride	401 " " "
Sorbitol (dry basis)	149 " " "
Glycerine (dry basis)	149 " " "
Litharge	0.4 " " "
Total Charge	1071 " " "
Yield	1000 " " "

This is an alkyd of 37-38% oil content, and 40% phthalic content.

#### COOKING DIRECTIONS

- (1) Charge oil and glycerine. Heat to 240°C adding PbO at 190°C on upbeat. Hold 240°C for 1/4 hour.
- (2) Add phthalic-anhydride and sorbitol.
- (3) Gain 220°C and hold for approximately 3 hours for an acid number of 5-8 and viscosity of W at 50% in mineral spirits.

Short oil length sorbitol-containing alkyds are useful in nitrocellulose lacquers, furniture enamels, metal sign paints and the like.

**Medium Oil Length Alkyds:** In medium oil length alkyds sorbitol is most efficiently used in conjunction with pentaerythritol where the sorbitol extends the use of

the pentaerythritol to shorter than normal oil lengths. Sorbitol can be used with glycerine in medium oil alkyds to improve resin properties and lower costs.

Table II contains a laboratory preparation of a medium length soya oil alkyd:

Table II

Soya Oil	534 pts. by wt.
Phthalic Anhydride	300 " " "
Sorbitol (dry basis)	110 " " "
Pentaerythritol	110 " " "
Litharge	0.3 " " "
 Total Charge	1054 " " "
Yield	1000 " " "

#### COOKING DIRECTIONS

(Using an inert gas blanket)

- (1) Charge oil. Heat to 240°C, adding litharge at 190°C.
- (2) Add pentaerythritol slowly, holding temperature at 235-240°C.
- (3) Hold 240°C for 40 minutes.
- (4) Add phthalic anhydride then sorbitol.
- (5) Gain 220°C and azeotropically distill (5-6 hrs.) using mineral spirits to an acid number of 10 and viscosity at 50% N.V. in mineral spirits of O.P (Gardner-Holdt). Reduce with mineral spirits to 50% N.V. This alkyd compares favorably in film properties with a comparable pentaerythritol-glycerine alkyd.

Medium oil length sorbitol-containing alkyds are useful in maintenance paints, quick drying enamels, porch, deck, and trim paints, and machine and implement enamels.

**Long Oil Alkyds:** Experience shows that pentaerythritol-sorbitol combinations are best suited for this type application. Sorbitol long oil alkyds are characterized by excellent color retention, gloss, and drying rate as well as hardness combined with good flexibility. The formulation in Table III is an example of a long, soya oil modified alkyd:

Table III

Soya Oil	617 pts. by wt.
Phthalic Anhydride	244 " " "
Maleic Anhydride	4 " " "
Sorbitol (dry basis)	90 " " "
Pentaerythritol	90 " " "
Litharge	0.4 " " "
 Total Charge	1045 " " "
Yield	1000 " " "

#### COOKING DIRECTION

- (1) Heat the oil and pentaerythritol to 235-240°C, adding the litharge at 190°C on the upheat.

- (2) Hold 235-240°C for 1/4 hour, then add the sorbitol.
- (3) Regain 235°C and hold for 1/4 hour.
- (4) Cool to 215°C, add the phthalic and maleic anhydrides.
- (5) Gain 235-240°C, hold for viscosity R at 60% in mineral spirits and acid number 8-10.

This alkyd compares favorably with a similar alkyd prepared from 60-40 pentaerythritol-ethylene glycol in air dry film properties.<sup>4</sup>

#### Sorbitol In Other Resins

Sorbitol is useful not only in alkyd vehicles, but also in other resinous systems where polyols are applicable. Some of these systems are tall oil esters, reconstituted oils, and hard gums.

#### Sorbitol In Tall Oil Esters:

Tall oil esters are usually considered as semi-drying oils or oil extenders. However, they are, in effect, actually ester gum type varnishes prepared "in situ" with the gum and oil formed simultaneously in the reaction mixture.

The relatively low unsaturation of the component fatty acids of tall oil results in their being slow-drying whereas the high resin content and the presence of certain impurities result in brittle films. Sorbitol is superior to most other polyols in bringing about the maximum drying rates of the tall oil fatty acids along with hardness of the ester gum and an enhanced adhesion and flexibility of the resulting films.

**Sorbitol In Reconstituted Oils:** Improved drying and bodying rates of conventional drying oils may be affected by replacing the glycerine radical of the oils with sorbitol. Improved toughness, and adhesion frequently result. Sorbitol linseed esters produce varnishes with superior adhesion characteristics, excellent resistance to sterilizing conditions and freedom from taste contamination. These properties make the sorbitol linseed ester particularly valuable in sanitary can coatings.

Reconstituted oils made from sorbitol body more rapidly than the corresponding glycerides, but not quite as fast as similar pentaerythritol oils. The sorbitol oils may be used for the preparation of varnishes by standard procedures. Varnishes may be made by cooking together directly rosin acids, sorbitol and oils.

Brandner, Hunter, Brewster and Bonner<sup>8</sup> made a systematic study of the conditions for esterification of sorbitol with linseed fatty acids. This paper covers the preparation of such drying oils.

**Sorbitol In Hard Gums:** One of the earliest reports on the use of sorbitol in coating vehicles is that of Goepp and Brown<sup>5</sup>. This paper stated that satisfactory ester gums and alkyds had been made from sorbitol. These resins were shown to compare favorably with corresponding glycerine resins, surpassing them in several properties. However, as mentioned above, high colors prevented their widespread adoption by industry.

Sorbitol rosin esters and maleic adducts are, unlike ester gum and glycerine-maleic adducts, compatible with both varnish oils and nitrocellulose lacquers. Moreover, in equal maleic concentrations and acid numbers the sorbitol resins uniformly melt at about 10°C higher than their glycerine analogues. The sorbitol rosins exhibit reduced viscosity in aromatic solvents permitting the preparation of high solids lacquers with fast solvent release while retaining the excellent hardness, rubbing characteristics and cold check resistance of the high-melting flexible resins.

As varnish gums, sorbitol esters are notable for their ready solubility in drying oils, in contrast to pentaerythritol rosins which are less soluble. Because of this oil solubility, sorbitol rosins are especially suited for fast or pre-bodied oils, as checking rosins, and in the preparation of vehicles where dispersion of high melting rosins with minimum oil bodying is desired.

Products made from mixtures of sorbitol and another polyol contain the superior properties imparted by the sorbitol as well as a versatility frequently unattainable with any single polyol. When used in a mixture with smaller amounts of glycerine in maleic-modified gums, sorbitol contributes high melting points at relatively low viscosities and faster solvent release. For high solids lacquers these properties are of distinct advantage. Further, sorbitol-containing maleic-modified

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# METHYL GLUCOSIDE

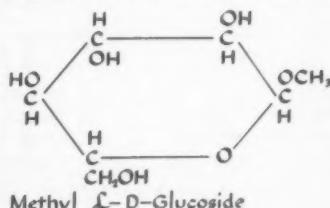
By  
J. P. Gibbons\*

THE functionality and configuration of methyl glucoside make this low-cost polyhydric alcohol a valuable raw material for the manufacture of reconstituted drying oils, varnishes and alkyd resins. Its tetrafunctionality (four hydroxyls) imparts fast bodying and drying characteristics to these vehicles, while its cyclic configuration contributes greater hardness and better through-dry and abrasion resistance to the films that can be obtained with the non-cyclic polyols. Not only can these desirable properties be built into vehicles with methyl glucoside, but also, by the use of improved reaction techniques, it is now possible to manufacture such products with colors that are quite suitable for most applications.

Methyl glucoside is manufactured by Corn Products Refining Company and sold under the brand name of Argo Brand Methyl Glucoside J361. Methyl glucoside, with the stereochemical configuration shown in Figure 1, has four hydroxyls available for esterification, one primary and three secondary. However, two of these hydroxyls appear to have approximately equal reactivity and are esterified more rapidly than the remaining two. Hence, in the esterification of methyl glucoside advantage can be taken of these differences in hydroxyl reactivities to produce lighter-colored ester products.

### Reaction Techniques

*Esterification:* The esterification of methyl glucoside with fatty acids requires temperatures above 375° F. to effect rapid reaction. In Figures 2 and 3 are shown the rates of esterification of 4 moles of fatty acids with 1 mole of methyl glucoside at 394° F. and 446° F.,



### DESCRIPTION OF PHYSICAL PROPERTIES

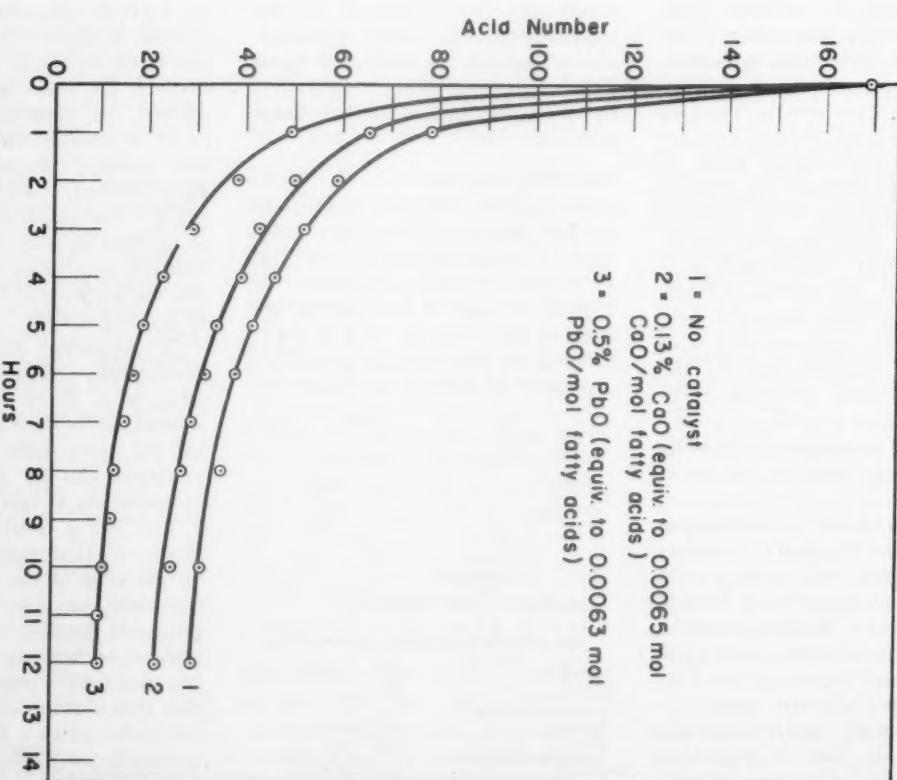
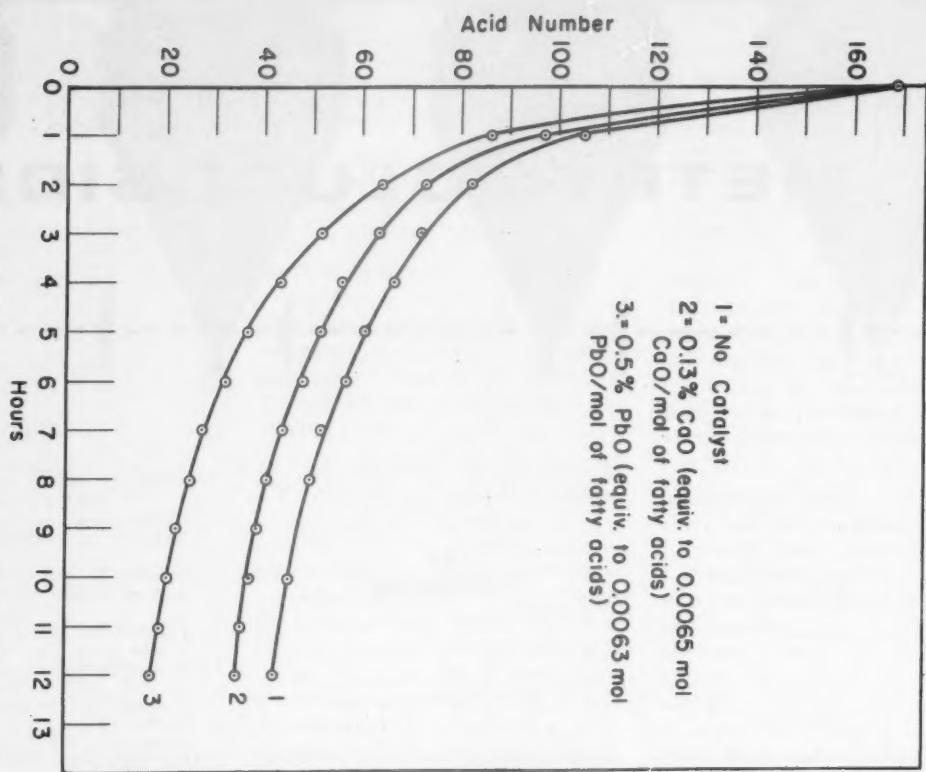
Appearance	White, crystalline powder
Odor	None
Melting point	164° C. min.
Specific gravity, 30/40° C.	1.46
Moisture	0.20% max.
Ash	0.05% max.
Methyl α-D-Glucoside	99% min.
Solubility	63 g/100 g water
Combining weight/hydroxyl	48.5 (calc.)

both with and without catalysts. Temperature has a definite influence on the rate of esterification of methyl glucoside. This influence is more important during the latter stages of the reaction in driving the esterification to completion, i.e. after an acid number of 85 is reached, or after the first two methyl glucoside hydroxyls have reacted, than it is up to that point. Catalysts are also helpful in promoting the esterification of methyl glucoside, litharge being the more effective for this purpose (Figures 2 and 3).

In preparing methyl glucoside tetraesters (reconstituted drying oils) with fatty acids, such as linseed, soya, dehydrated castor or tall oil fatty acids, lighter-colored products can be obtained if the temperature is held between 375° F. and 390° F. during the first part of the reaction until approximately 50 per cent of the esterification is complete, i.e. two of the methyl glucoside hydroxyls are esterified, instead of heating directly to the top reaction temperature. When this initial stage of the reaction is complete, raising the temperature gradually over one hour to the top reaction temperature will accelerate the esterification. With the more

\*Technical Service Dept., Corn Products Refining Co., Argo, Ill.

Figure 1.



unsaturated fatty acids, such as linseed and dehydrated castor, top temperatures of 460° F. to 480° F. are recommended. With the less reactive soya or tall oil fatty acids top temperatures as high as 500° F. can be employed. The use of a litharge catalyst will increase the rate of reaction, while employing combinations of anthraquinone or methyl anthraquinone and litharge aids in producing methyl glucoside esters (oils) with low acid numbers and light color. When this catalyst combination is used, toward the end of the reaction as the acid number reaches about 10, the oils begin to bleach out. This bleaching effect is not observed when either the anthraquinone or litharge are used alone as catalyst. On completion of the esterification, the lead catalyst can be removed quantitatively by addition of a 0.7 grams of adipic acid for each gram of litharge catalyst on the cooling cycle at 300° F. Insoluble lead adipate is formed, which can be separated by filtration along with the anthraquinone.

*Alcoholysis:* For the alcoholysis of oils, such as linseed, soya, dehydrated castor, etc., with methyl glucoside, lithium and sodium compounds are the most effective catalysts. Recommended procedure for carrying out this reaction is to heat the oil and catalyst under an inert atmosphere to approximately 520° F., then add the methyl glucoside slowly over a 30 minute period, taking care not to allow the temperature to fall below 500° F. The addition of four equal portions of methyl glucoside at 10 minute intervals is satisfactory; this takes 30 minutes. After the last of the methyl glu-

coside has been introduced, the reaction is held at 500° F. for 1 to 1.5 hours to insure completion of the alcoholysis. This holding period is necessary since no satisfactory test has been found for determining completion of this reaction with methyl glucoside. For the preparation of an alkyd, after the alcoholysis cycle is finished, the reaction product is cooled to 380° F. and then the dibasic component incorporated. Better-colored products, with suitably low acid numbers, will be obtained in a shorter total reaction time if the following heating cycle is employed: After addition of the dibasic acid at 380° F., regain 400° F. over 0.5 hour, hold for 1 hour, then gradually heat to the top reaction temperature over a 1 hour period and maintain for acid number and viscosity. Adding the dibasic acid at a higher temperature, or heating rapidly to the top temperature after addition of the dibasic acid at 380° F., will not only prolong the reaction but will yield darker-colored products. After addition of the dibasic acid, either fusion or solvent cooks can be employed to complete the esterification. Adding a little anthraquinone to the oil before alcoholysis will have a beneficial effect on the color of the finished alkyd product.

#### Reconstituted Drying Oils

The properties imparted to its reconstituted drying oils by the methyl glucoside molecule are indicative of the effect this polyol will have on the properties of other coating vehicles of which it is a constituent. The methyl glucoside-linseed fatty acid drying oils are characterized by rapid bodying

rate, fast dry to relatively hard films having excellent adhesion and good water resistance. These same properties are carried over to the phenolic and ester gum varnishes made with these oils. In Table I are summarized linseed fatty acid esterifications of methyl glucoside, glycerol and pentaerythritol. The oils were all prepared by fusion cook using a carbon dioxide sparge to facilitate removal of the water of esterification. The heating cycles employed in the methyl glucoside and glycerol cooks were similar to that described above for the esterification of methyl glucoside. In the pentaerythritol esterification, all the reactants were heated directly to 446° F. and until the desired acid number is reached.

Figure 4 shows the bodying characteristics of the different synthetic oils at 590° F. under carbon dioxide following the procedure of Von Mikusch (Ind. Eng. Chem. 32,1061 (1940)). Each oil was heated rapidly to 590° F. and, when a sample indicated a viscosity of 2.5 poises was reached, timing was begun. It can be seen from Figure 4 that the methyl glucoside oil has a decidedly faster bodying rate than either of the other two synthetic oils.

The film properties of the different oils are given in Table II. For this evaluation, each oil was bodyed to a Gardner viscosity of Z-2 to eliminate, as far as possible, any effect differences in viscosities of the various oils might have on the drying rate. The drying times were determined on inch-wide films of 0.003 in. wet thickness laid down side by side on a large glass plate

Polyol	Mol Ratio Linseed Fatty Acids to Polyol	Catalyst Based on Fatty Acids	Total Hr. for Reaction	Max. Temp. (°F)	Properties of Esters			Sap. No.
					Visc. <sup>1</sup>	Color <sup>2</sup>	Acid No.	
Methyl Glucoside	4:1.07	0.5% PbO	6.5	446	G	11	5.5	176
Methyl Glucoside	4:1.07	0.5% PbO	6.0	480	G	8	6.1	176
		0.5% Anthraquinone						
Glycerol	3:1.05	0.5% PbO	5.5	446	H	6+	1.6	186
Pentaerythritol	4:1.05	None	4.5	446	D	8+	11.6	184

<sup>1</sup> Gardner Bubble Viscometer.

<sup>2</sup> Gardner Hellige Comparator.

Table I. Preparation and properties of linseed fatty acids drying oils.

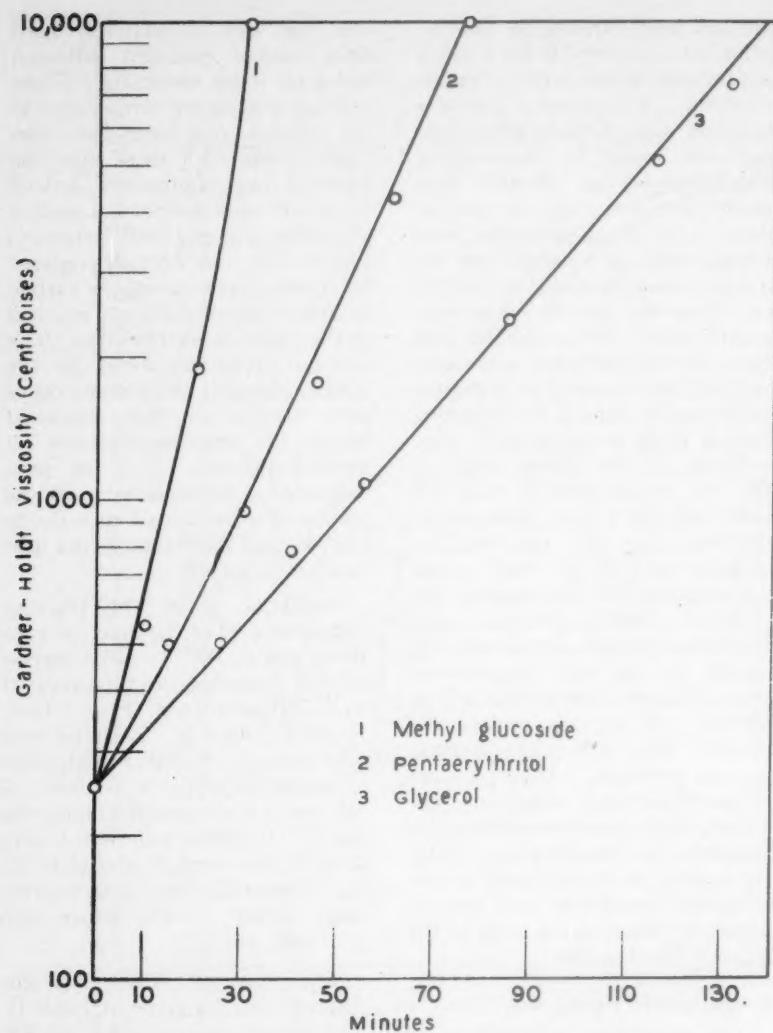


Figure 4. Bodying of esters of linseed acids and various polyols at 590 deg. F.

(25 in. x 25 in.) by means of a ring applicator, and sand was drawn across the films periodically. The

time at which the sand would no longer adhere to each film gave a record of the comparative drying

times. The methyl glucoside oil dried faster to harder films with equivalent or superior hot and cold water resistance than those made with the other polyols. Another interesting property of the un-bodied methyl glucoside-linseed fatty acid drying oils is that these products with viscosities of H to J containing a naphthenate metal drier combination of 0.5% lead, 0.05% of cobalt and 0.025% manganese on the solids, will air-dry to a fine wrinkle finish. In this respect, the methyl glucoside-linseed synthetic oil exhibits some of the characteristics of tung oil.

The preparation and properties of 25 gallon oil-length varnishes of Bakelite resin BR254 made with the different oils are given in Table III, while in Table IV are shown similar data for 50 gallon oil-length varnishes prepared with an ester gum. The varnishes containing the methyl glucoside oil have shorter kettle times and dry more rapidly to harder films with equivalent or superior water and alkali resistance than the varnishes prepared with the two other oils. In addition, the varnishes made with the methyl glucoside oil dry to films with higher Sward hardness values, which indicates better through-dry. The same properties obtained with the methyl glucoside-linseed fatty acid drying oil can be translated to other types of synthetic drying oils, such as those made with dehydrated castor, soya, tall oil fatty acids and distilled grade of tall oil.

#### Varnishes

*Tall Oil Varnishes:* Tall oil esters

Drying Oil	Viscosity <sup>1</sup> (70% NVM) at 70°F	Color <sup>2</sup>	Time (hr.)	Water Resistance		1% Alkali Resistance	Sward Hardness After:			
				Drying <sup>3</sup> (hr. to fail)	Cold Hot (1 hr.)		24 hrs.	48 hrs.	72 hrs.	96 hrs.
Methyl Glucoside PbO-Anthraquinone	E	9	1.0	288	ok	4	4	6	8	8
Glycerol PbO Cat.	F	9	6.25	72	U <sup>4</sup>	1	2	4	4	4
Pentaerythritol No Cat.	F	10	2.25	248	ok	2	4	4	4	4

<sup>1</sup> Gardner Bubble Viscometer.

<sup>2</sup> Gardner Hellige Color Comparator.

<sup>3</sup> Naphthenate drier combination of 0.5% Pb, 0.05% Co and 0.025% Mn as metals added on solids.

<sup>4</sup> Unsatisfactory—film failed.

Table II. Properties of bodied linseed fatty acid drying oils.

Drying Oils	Cooking Schedule					5% <sup>4</sup>	Alkali Resistance (hr.)	Water Resistance 48 hr. 70°F	Sward Hardness <sup>5</sup> after;			
	Linseed Fatty	Temp. (°F)	Holding Time (min.)	Gardner <sup>1</sup> Viscosity (77°F)	Color <sup>2</sup>				24 hrs.	48 hrs.	72 hrs.	96 hrs.
Methyl Glucoside PbO-Anthraquinone		572	35	G	8	2.25	41	ok	24	34	34	34
Glycerol PbO Cat.		572	80	G	12	3.75	12	ok	8	18	18	18
Pentaerythritol No Cat.		572	60	F	9	3.50	41	ok	14	22	22	22

<sup>1</sup> Gardner bubble viscometer at 60% NVM (20% xylene, 80% VM&P by volume).

<sup>2</sup> Gardner-Hellige comparator.

<sup>3</sup> Naphthenate drier combination of 0.5% Pb, 0.05% Co and 0.025% Mn as metals added on solids.

<sup>4</sup> Hours to failure.

<sup>5</sup> Rocker standardized at 100 on glass.

Table III. Preparation and properties of 25 gallon oil length varnishes.

of polyhydric alcohols possess properties which make these products useful in the preparation of low-cost varnish vehicles, core-binders and extenders for the more expensive natural oils in the manufacture of paints and linoleum. The tall oil esters of methyl glucoside are characterized by the same improved properties as described above for the methyl glucoside linseed drying oil and its varnishes, i.e., faster dry to harder films than esters prepared with non-cyclic polyols.

In esterifying tall oil with methyl glucoside, the fatty acid portion reacts readily at 390° F. to 500° F., while the resin acids are more difficult to esterify and require temperatures above 500° F. In carrying out this reaction, it is recommended that the cook be held at 390° F. to 400° F., to complete the esterification. With distilled

tall oils (approximately 30 per cent rosin acids) and a litharge catalyst, esters can be prepared with Gardner colors of 12 to 14, depending on the brand of tall oil employed. The use of anthraquinone (0.5 to 1.0 on the weight of tall oil) in conjunction with the litharge will improve the color by about two Gardner units.

In Table V are given data on the preparation and properties of methyl glucoside-tall oil esters made with two different grades of tall oil. All these esters were prepared by fusion cook using a carbon dioxide sparge. Tall oil A (Acid No. 188, Color 56) contained 67 per cent fatty acids and 30 per cent rosin acids, while tall oil B (Acid No. 191, Color 8 to 11) consisted of 66 and 32 per cent fatty and rosin acids, respectively.

Unmodified polyhydric alcohol-tall oil esters do not possess very

good alkali resistance. This property can be improved by using combinations of methyl glucoside-epoxy resins to esterify the tall oil, for example Ester No. 5 in Table V. Such products, although not having as good alkali resistance as a 100 per cent epoxy resin-tall esters, are much less costly vehicles to produce.

The methyl glucoside-tall oil esters are useful in the preparation of low-cost floor, deck and drum enamels, printing ink and core-binders. In linoleum manufacture, the selective esterification of the fatty acid portion of tall oil with methyl glucosides, using a top reaction temperature of 470° F., gives a product consisting of tall oil fatty acid tetraester of methyl glucoside and free rosin acids. Blends of such a product with more expensive natural oils produce ma-

Drying Oils	Cooking Schedule					Drying <sup>4</sup>	Water Resistance			1% Alkali Resistance	Sward Hardness <sup>5</sup> After;			
	Linseed Fatty	Temp. (°F)	Holding Time (hr.)	Gardner <sup>2</sup> Viscosity at 77°F	Color <sup>3</sup>		Cold After 24 hr.	Hot (1 hr.)	Min. to Fail		24 hrs.	48 hrs.	72 hrs.	96 hrs.
Methyl Glucoside PbO-Anthraquinone		590	1.9	H	9	4.0	ok	ok	180	28	32	48	50	52
Glycerol PbO Cat.		590	6.0	G	11	9.0	ok	ok	7	14	18	22	28	28
Pentaerythritol No Cat.		590	2.3	G	9	5.5	ok	ok	210	14	18	20	24	28

<sup>1</sup> Resin—Hercules Ester Gum 8L.

<sup>2</sup> Gardner Bubble Viscometer

<sup>3</sup> Gardner Hellige Comparator

<sup>4</sup> Naphthenate driers of 0.5% Pb, 0.05% Co and 0.025% Mn on solids added.

<sup>5</sup> Rocker standardized at 100 on glass.

Table IV. Preparation and properties of 50 gallon length varnishes.

Ester No.	Tall Oil A		Tall Oil B		
	1	2	3	4	5
Tall Oil (parts b.w.)	100.0	100.0	100.0	100.0	100.0
Methyl Glucoside (parts b.w.)	17.4	17.4	17.5	17.5	12.1
Epon 1004 (parts b.w.)	—	—	—	—	57.5
% Anthraquinone on T.O.	—	1.0	—	1.0	17.5
% Litharge on T.O.	0.5	0.5	0.5	0.5	—
Cooking Cycle	hrs. at 400°F	1.0	1.0	1.0	2.0
	hrs. at 450°F	1.0	1.0	1.0	3.0
	hrs. at 535°F	8.0	8.0	8.0	—
	hrs. at 550°F	—	—	—	3.5
Acid No. at 100% NVM	10.4	10.3	11.6	11.5	9.0
Color (Gardner 1933)	12	10	14	12	16
at 100% NVM	—	—	—	—	—
at 75% NVM in M.S.	12	10	13	12	—
at 50% NVM in M.S.	—	—	—	—	14
Viscosity	at 100% NVM	Z <sub>6</sub>	Z <sub>4</sub>	Z <sub>4</sub>	—
	at 75% NVM in M.S.	B	C	D	E
	at 50% NVM in M.S.	—	—	—	B
Dry Time <sup>1</sup> (0.003" wet thickness) hrs.	20	21	9	8	8
Hardness (Sward) (0.003" wet thickness)	at 24 hrs.	20	26	28	20
	at 48 hrs.	24	24	34	28
	at 72 hrs.	28	29	40	38
	at 2 wks.	31	32	42	39
Cold Water Resistance <sup>2</sup>	at 24 hrs. (blush)	med.	med.	med.	sl.
	time to recover (hrs.)	2.0	2.0	0.5	1.0
Hot Water Resistance <sup>3</sup>	30 min. boiling water immersion	OK	OK	OK	OK
	alkali resistance (3% aq. NaOH) hours to fail	OK	OK	OK	OK
	—	—	—	—	5

<sup>1</sup> Sand Method—Driers for tall oil varnishes 1.0% Pb and 0.1% Co or NCN added as naphthenates; for Methyl Glucoside—Epon 1004—tall oil varnish, 0.5% Pb and 0.05% Co on solids added as naphthenates.

<sup>2</sup> Test tubes dip-coated and allowed to dry 48 hours before testing.

<sup>3</sup> Varnish flowed on #20 gauge steel plate and allowed to dry 48 hours before testing.

Table V. Preparation and properties of tall oil esters.

Ester No.	Tall Oil A		Tall Oil B		Oil length of varnish (gallons)		
	1	2	3	4	5	20	25
Linseed oil (Y body; color 5-6)	100.0	100.0	100.0	100.0	100.0	100.0	100.0
W/W rosin	17.4	17.4	17.5	17.5	12.1	57.5	50.0
Maleic anhydride	—	—	—	—	—	—	2.5
Methyl glucoside	—	1.0	—	1.0	—	8.8	10.5
Lithium naphthenate (Nuodex—1.4% lithium)	—	0.5	0.5	0.5	0.5	0.5	0.5
Anthraquinone	0.5	0.5	0.5	0.5	0.1	0.1	0.1
Cooking cycle	hrs. at 500°F	1.0	1.0	1.0	1.0	0.5	4.5
	hr. at 550 to 570°F	—	—	—	—	—	—
Acid No. (100% solids)	10.4	10.3	11.6	11.5	9.0	7.7	6.0
Viscosity (50% in mineral spirits)	12	10	14	12	16	B-C	E
Color (Gardner 1933 in mineral spirits)	12	10	13	12	—	8+	10
Drying time <sup>1</sup> hr. (0.003" wet thickness)	—	—	—	—	5.0	5.5	5.5
Hardness (Sward) (0.003" wet thickness)	at 24 hr.	20	26	28	20	37	36
	at 48 hr.	24	24	34	28	42	40
	at 72 hr.	28	29	40	38	42	41
	at 2 weeks	31	32	42	39	49	48
Cold water resistance <sup>2</sup>	at 24 hr. (blush)	med.	med.	med.	sl.	V.Si.	V.Si.
	time to recover (min.)	2.0	2.0	0.5	1.0	15	15
Hot water resistance <sup>3</sup>	30 min. boiling water immersion	OK	OK	OK	OK	OK	OK
Flexibility (1/8" mandrel) <sup>3</sup>	48 hr.	—	—	—	—	OK	OK
	2 weeks	—	—	—	—	OK	OK

<sup>1</sup> Sand Method—Varnishes contained 0.5% Pb, 0.05% Co and 0.25% Mn on oil added as naphthenate.

<sup>2</sup> Test tubes dip-coated and allowed to dry 48 hours before testing.

<sup>3</sup> Varnish flowed on #20 gauge steel plate and allowed to dry 48 hours before testing.

Table VI. Preparation and properties of *in situ* varnishes.

aterials suitable for the preparation of a low-cost linoleum bases.

*"In Situ" Varnishes:* Methyl glucoside is readily adaptable to the "in situ" technique for the preparation of oleoresinous vehicles. Varnishes of this kind made with methyl glucoside dry rapidly to hard films which possess good flexibility and water resistance. In the preparation of these vehicles with methyl glucoside, it is recommended that the oil, rosin and catalyst be heated together with stirring under an inert atmosphere to 500° F. before adding the polyol. After the methyl glucoside has been incorporated, the temperature should be held at 500° F. to 520° F. for 0.5 to 1.0 hours raising to 550° F. to 570° F. to complete the cook. Using a carbon dioxide sparge at the top temperature tends to accelerate the reaction. When maleic or fumaric modification is employed, the rosin adduct is formed by incorporating the dibasic acid on the up-heat at 300° F.

In Table VI are given the charges and heating cycle for the preparation of 20 gallon oil-length linseed oil-rosin-methyl glucoside and 25 gallon oil-length maleic-modified linseed oil-rosin-methyl glucoside "in situ" varnishes. Included also are some of the properties of these vehicles.

#### Alkyd Resins

Oil-modified alkyd vehicles containing methyl glucoside are best prepared by alcoholizing the triglycerides with this polyol followed by reaction with dibasic acids, such as tetrahydrophthalic or maleic anhydrides or fumaric, succinic, adipic, sebacic or azelaic

Oil Content (per cent)	65	70	75	80	65	75	80
Linseed Oil (parts b.w.)	100.0	100.0	100.0	100.0	—	—	—
Soybean Oil (parts b.w.)	—	—	—	—	100.0	100.0	100.0
Methyl Glucoside (parts b.w.) <sup>1</sup>	25.2	18.4	14.4	11.1	25.0	16.5	12.5
Tetrahydrophthalic Anhyd. (part b.w.)	33.5	26.9	21.0	15.8	34.2	—	—
Adipic Acid (parts b.w.)	—	—	—	—	—	22.5	16.5
Lithium Carbonate (parts b.w.)	0.2	0.1	0.1	0.1	0.2	0.1	0.1
Anthraquinone (parts b.w.)	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Heating Cycle <sup>2</sup>							
hrs. at 400° F	1.0	1.0	1.0	1.0	3.5	1.0	1.0
hrs. to top temp.	1.0	1.0	1.0	1.0	1.0	1.0	1.0
hrs. at 435° F	6.5	—	—	—	—	—	—
hrs. at 460° F	—	2.0	—	4.0	—	8.5	8.5
hrs. at 470° F	—	9.0	12.0	4.0	5.0	—	—
hrs. at 510° F	—	—	—	—	3.0	—	—
Acid No. at 100% NVM	12.0	6.6	8.6	7.7	6.0	7.6	7.0
Color (Gardner 1933) at 100% NVM	10	8	7+	6+	10	8+	6+
Viscosity (Gardner-Holdt) at 77° F							
at 100% NVM	—	Z <sub>10</sub>	Z <sub>3</sub>	Q	—	Z	U
at 70% NVM in M.S.	—	V-W	—	—	—	—	—
at 50% NVM in M.S.	E	C-D	—	—	L	—	—

<sup>1</sup> Ten per cent hydroxyls over theoretical used in cooks.

<sup>2</sup> Heating cycle after addition of dibasic acid constituent at 380° F and regain of 400° F over 0.5 hours.

Tables VII. Preparation and properties of oil-modified alkyds.

acids. Phthalic anhydride gives very dark-colored products. The long oil-modified methyl glucoside-tetrahydrophthalic alkyds dry quickly to tough, hard, flexible films with good gloss; the drying times, film hardness, gloss and water resistance are comparable to alkyd resins of shorter oil-length made with phthalic anhydride and other polyols. Tetrahydrophthalic-methyl glucoside-linseed oil alkyds (70 to 80% linseed oil) at 100 per cent solids make excellent printing ink vehicles, possessing good grinding and pigment wetting properties. The resulting ink have good workability and stay open on the press, yet dry faster to films with better adhesion, hardness and scuff-resistance than inks made

with the usual vehicles employed for this purpose. An added advantage of the methyl glucoside-tetrahydrophthalic alkyds is that they develop truer colors with pigments than the conventional alkyds.

Soybean oil-methyl glucoside-adipic alkyds (75 to 80% soybean oil) are excellent plasticizing vehicle for heat-reactive phenolic and hydrocarbon type resins. Varnishes made with these alkyds and heat-reactive phenolics have excellent baking characteristics, curing rapidly to tough, hard, flexible films with good adhesion both to metal and glass surfaces. When used as a metal decorative coatings can-

(Turn to page 161)

Resin	Resin Properties					Film Properties <sup>1</sup>				1% NaOH <sup>2</sup>					Sward Hardness (Hrs.)				
	NVM %	Visc. at 77° F		Color	Acid No.	NVM %	Wet Film mil	Drying <sup>3</sup> Time Hrs.	Resist. Min. to Recover	H <sub>2</sub> O <sup>4</sup>		Resist. Min. to Fall	24 48 72 96 168						
		70	Z		6.4	50	3	4.0		— <sup>4</sup>	1	4	4	4	5	6			
65% Soy-Phthalic (commercial)	50	W	6	5.1	25	5	4.0	— <sup>4</sup>	1	14	14	16	16	16	16	16			
58% Soy-Phthalic (commercial)	50	L	9+	3.6	50	3	2.0	No blush	6	16	18	22	22	26	26	26			
65% Soy-MG-THPA	100	Z <sub>10</sub>	9	6.6	50	3	2.25	15	4	16	22	26	26	26	29	29			

<sup>1</sup> Driers: 0.5% Pb and 0.05% Co on solids added as naphthenates.

<sup>2</sup> Drying times by Sand Method.

<sup>3</sup> Test tubes dipped, coated and dried 168 hours before testing.

<sup>4</sup> Lost adhesion.

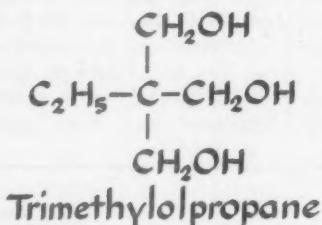
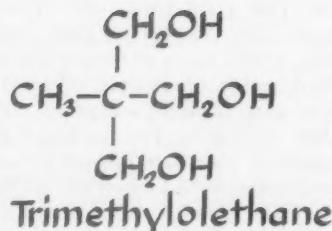
Table VIII. COMPARISON of film properties of alkyds.

# TIME and TRADE

By  
William M. Kraft\*

VERSATILITY is one of the characteristics that have won for alkyd resins their dominant position in surface coatings. They are used in more types of coatings than any other resin and continue to find new applications as advances are made in raw materials and technology. Largely accounting for this versatility is the wide choice of materials for the three alkyd components—polyhydric alcohols, polybasic acids and oil or monobasic acid modifiers. In addition, a number of polymerizable or reactive materials can be used for further modification or in combination with alkyds. This variety of starting materials makes it possible to produce high quality coatings for numerous purposes, that are unmatched at their low cost.

Trimethylolethane and trimethylolpropane are two of the newer raw materials for alkyds and other resins. Made by condensing formaldehyde with propionaldehyde and butyraldehyde, respectively, both are related to pentaerythritol and have the same stable neopentyl structure.



Trimethylolethane has been produced in substantial volume in Germany for some years, particularly for polyurethane resins. Commercial production in the U. S. was begun several years ago in conjunction with the development of isocyanates here. It has found use primarily in polyurethane resins, which will be considered later.

Trimethylolethane, which was introduced commercially several years ago, has been used more extensively in alkyd resins, in which

its lower molecular weight and higher hydroxyl content give it an advantage cost-wise over trimethylolpropane. The latter contributes similar advantages in alkyds, but considerably more data and experience are available on trimethylolethane in this field. A new development in trimethylolethane is the recent marketing of a lower cost technical grade, containing about 10% di-trimethylolethane. This product gives the same results as the original material, requiring only a small adjustment of equivalent weight for direct replacement, and promises to considerably broaden the field of utility.

With its primary hydroxyl groups, solubilizing methyl group and stable neopentyl structure, trimethylolethane reacts smoothly and rapidly in alkyd processing and shows a minimum of volatilization, discoloration or decomposition. The resulting finishes exhibit outstanding color and gloss retention on exposure to heat, ultra-violet light, or weather, as well as good compatibility and superior alkali resistance and hardness. They are

TME and TMP are the registered trademarks for pure trimethylolethane and pure trimethylolpropane produced by the Heyden Newport Chemical Corp.

\*Heyden Newport Chemical Corp., Research Laboratories, Garfield, N. J.

finding increasing use in color and gloss retentive high quality industrial enamels, appliance and automotive finishes, and some architectural paints.

#### Processing

The greatest utilization of trimethylethane, at present, appears to be in the areas of medium and short oil alkyd resins, in which its functionality of three permits formulation of a wide variety of compositions. It is also possible to combine it with polyols of higher functionality, such as pentaerythritol, to obtain compositions which are in the long oil area. The full effects of the use of trimethylethane are realized best when it is the sole polyol in the alkyd system; however, improvement in qualities can also be achieved when natural oils are used. Examples of both kinds of products will be given in the subsequent information on resins.

The polyol can be processed by the conventional techniques of fusion or solvent type cooking in both oil modified and acid modified procedures. Because of its excellent solubility at reaction temperatures, clear homogeneous systems and fast reaction are obtained in either oil or fatty acid cooks. This is particularly evident in isophthalic-TME combinations where processing with the usual solvent

techniques leads to no sublimation of diacid. The usual alcoholysis procedures are also applicable. A minimum of catalyst such as litharge should be used to carry out this reaction to achieve freedom from discoloration and haze. Optimum alcoholysis conditions are 230°C. (446° F.) with .01% of litharge based on oil. In the case of a fatty acid cook, an esterification temperature of 245° C. (473° F.) is suggested to achieve short time cycles without undue color formation.

#### Resin Formulation and Properties

In comparing polyols in alkyd formulations, three methods may be used: equal oil length, equal phthalic content, and equal molecular amounts. According to the recent publication of the "Molecular Approach to Alkyd Structure",<sup>1</sup> the latter appears to offer a better basis of comparison. Table I shows the three approaches together with the properties achieved with the various trifunctional alcohols.

It is apparent that comparable viscosities and dry times are achieved with the molecular approach. Trimethylethane and trimethylolpropane give similar early hardness values but after 28 days are harder than glycerol.

When the three polyols are compared in alkyds with similar phthal-

ic contents, the trimethylethane and trimethylolpropane vehicles show higher viscosity, faster dry, and greater hardness. Thus, where specifications exist which limit phthalic content, it is possible to use less amino or other resins to obtain greater hardness for the entire system.

With the equal oil length approach, lower viscosities are noted with trimethylethane and trimethylolpropane. This behavior might be used to gain higher solids vehicles in a particular solvent combination. This also permits the use of less expensive solvents with alkyds based on these polyols. In all cases, the trimethylethane and trimethylolpropane show better alkali resistance qualities.

Due to the improvements in hardness, resistances, dry time, and curing rate gained through the use of trimethylethane and trimethylolpropane, the cost of coating systems may be reduced indirectly. Thus, tall oil fatty acids may be used in the alkyd formulation. In addition, these compositions can be further improved in dry time and resistance by the use of the High Polymer Alkyd Technique<sup>2</sup>.

Table II shows the comparative film properties of a glycerol and several trimethylethane technical resins in typical resin and paint systems. The notable advantages

All resins made at 245°C. Viscosity in Xylo at 60% N.V.  
Acid No. = 9-10. Air dried films contained 0.5% Pb + 0.05% Co.  
Baked films contained 0.02% Mn. Baked at 150°C.  $\frac{3}{2}$  hour.

Polyol	Glycerol	TME				TMP			
		Approach	—	Equal Molar	Equal Phthalic	Equal Oil	Equal Molar	Equal Phthalate	Equal Oil
Mole Ratio									
PA/Polyol/FA	1/1/.70	1/1/.70		1/1/.60		1/1/.75	1/1/.70	1/1/.56	1/1/.77
Viscosity (G-H)	J	G		T		E	H	P	F
Film Properties Air Dry 0.5% Pb + 0.05% Co									
Set to Touch	:45	:34		:19	1:32	:40	:26	1:31	
Tack Free	4:00	3:51		1:04	4:02	4:00	:55	5:01	
Hardness									
1 d.	4	6		8	6	6	8	4	
14 d.	18	18		20	16	20	28	16	
28 d.	20	34		38	32	34	36	22	
Baked Films 300°F 1 hr. — No catalyst									
3% NaOH Resist.									
1st attack	:15	8:		3:	8:	5:	3:	8:	
Denude	86:	220		269	200	195	286	187	

Table I. Resin and Film Properties—Tall Oil Fatty Acid Alkyds.

Type Resin	TME-TOFA-PA Conventional	TME-TOFA-PA High Polymer	TME-TOFA-IPA	Glycerol-Soy Oil
Mole Ratio Diacid/Polyol/FA	1/1/.6	1/1/.6	88/1/.6	1/1/.6
Resin Viscosity 60% NV in Xylool	S+	W+	Y	Z
Air Dry 0.5% Pb + 0.05% Co				
Tack Free (Hours: Minutes)	10:38	5:17	10:40	9:53
Foil Dry	12:37	10:11	24:11	12:38
Hardness 14 days	22	22	14	20
3% NaOH Denude Time	41:	66:	43:	23:
Baked 300°F. 1 hour No catalyst				
Hardness	14	16	14	12
3% NaOH Denude Time	68	454	68	41
Pigmented Films Baked 300°F. 30 minutes				
Paint Viscosity' KU	61	73	75	80
Initial Color	87.3	88.3	87.5	88.3
% Color Retention 24 hr. 300°F.	80.5	82.7	81.4	74.8
Initial Gloss	95	95	91	92
% Gloss Retention 24 hr. 300°F.	88.4	90.5	94.5	84.8
3% NaOH, Denude, Hrs.	30	129	26	26
Pencil Hardness	3B	3B	4B	3B

Table II. TME—Technical vs. Soy Oil Glycerol Resins.

in hardness, alkali resistance, dry, gloss and color are evidence of their value in appliance, automotive, and other high quality finishes.

#### RESIN PREPARATION (TABLE II)

1. The conventional trimethylolethane resin was prepared by charging 1.0 mole of phthalic, 1.0 mole of TME Technical, and 0.6 mole fatty acid to a resin kettle. The resin was prepared by a solvent process at 245°C., taken to an acid number of 9.7, and diluted to 60% non volatile in xylool.

2. The High Polymer alkyd was prepared in a manner similar to (1) except that only 0.42 moles of fatty acid were added initially. The resin was cooked at 245°C. to an acid number of 11 and the remainder of fatty acid, 0.18 moles, added. The resin was taken to a final acid number of 8.4.

3. The isophthalic resin was prepared in a solvent (xylool) type cooking procedure at 245°C. similar to (1). The final acid number was 9.1. The use of lower molar amounts of isophthalic is required because of the gelation at higher levels. (See reference 1 for details).

4. The glycerol resin was prepared by alcoholysis of soy oil with glycerol at 230°C. using 0.01% litharge. Phthalic anhydride was added and the preparation continued with the solvent method. The final acid number was 9.2.

5. The pigment formulation used was

Titanium dioxide  
(R-750 N. J. Zinc Co.) 166  
Resin 276  
Xylool 58

The quality achievable with these polyols enables the preparation of stable and highly resistant metal, automotive, and appliance primer and topcoat systems when the alkyd is modified with benzoic acid. Thus, a trimethylolethane soy benzoic acid alkyd has outstanding properties as a metal primer as compared with medium

and long oil epoxy esters. Its low cost, fast conversion, adhesion, salt spray resistance, and chemical resistances are noteworthy features.

#### FORMULATION FOR PRIMER

##### TME Benzoic Soy Alkyds

TME Technical 27.0  
Benzoic Acid 4.9

Soy Fatty Acids 34.4

Phthalic Anhydride 33.7

Charge all ingredients to the resin kettle. Esterify using xylool as the azeotrope solvent at 245°C. (473°F.) until the acid number is 9. Cool and dilute to 60% NV with xylool.

Viscosity (Gardner-Holdt) was U.V.

This vehicle also has gained interest in enamel topcoats because of its color and gloss retention and hardness without amino resin modification.

Trimethylolethane baking type finishes have excellent heat stabilities, color and gloss retention and therefore have found use in appliance and automotive applications. Such vehicles can be applied with considerable freedom from overbake discoloration.

Because of their superior hardness and other properties, these baking vehicles make possible the use of low quantities of modifying amino resins resulting in economies for the entire coating system. Thus, a high melamine finish would require a 30% content with a glycerol resin, whereas only 15-20% would be necessary in the case of the trimethylolethane system.

Table III describes some of the pertinent resin and paint data of such vehicles for use in automotive and appliance finishes. Greater resistance to chalking and better gloss retention has been noted in Florida exposures in comparison with glycerol based resins. (Table IV)

As indicated previously, it is also possible to prepare vehicles from natural oils. A formulation for a coconut oil modified resin is given in the table below.

	%
Coconut oil (Silverseal)	29.8
TME Tech.	28.9
Phthalic Anhydride	41.3
	100.0

#### PROCEDURE.

1. Alcoholize the coconut oil and TME Technical with 0.03% lithium hydroxide for 1/2 hour at 230°C. Add the phthalic anhydride.

2. Esterify at 245°C. with xylool reflux to Viscosity will be approximately U at 50% solids in xylool.

To summarize the results in alkyds, it can be seen that the advantages in performance qualities gained by the use of TME include:

1. Heat stability and resistance to overbake
2. Gloss retention
3. Color retention
4. Alkali and detergent resistance
5. Weatherability
6. Resin compatibility with solvents and amine resins.

Other areas of investigation

	Glycerol 30% Mel. (1)	TME 20% Mel. (2)	TME 20% Mel. (3)
Formulation	1/1/44	1/1/38	1/1/44
Visc. of alkyd	Z <sub>2</sub>	X+	T+
Sward Hardness	42	42	46
Gloss	76	89	86
Flexib. (Mand.)	OK 3/16"	OK 3/16"	OK 3/16"
Adhesion	OK	OK	OK
Water Resist.			
Cold 144 hrs.	cons. bl.	sl. bl.	sl. bl.
Hot 15 min.	cons. bl. no rec.	sl. bl. 100% rec.	sl. bl. 80% rec.
Humidity Resist. 90% RH—90°F. 4 mos.	mod. chalk	slight chalk	slight craze
NaOH Resist. Attack			
1st denude	2d	2d	3d
	7d	9d	9d
Tide Resist.			
1st denude	2d	3d	2d
	21d	28d	21d
Reflectance			
Initial { 16 hrs. at 400°F.	88.7	88.7	88.4
Final {	67.5	79.6	77.3
%Retention	76	90	88

Notes:  
Alkyd Formulations (all prepared by solvent method)

	1	2	3
Phthalic	44.5	43.0	41.0
Lauric	27.0	22.0	25.0
Glycerol	28.5	—	—
TME	—	35.0	34.0
Visc. 50% NV Xylo	Z <sub>2</sub>	X+	T+

Table III. Lauric Acid Alkyds Pigmented.

which also indicate promise include the preparation of styrene or methyl methacrylate modified alkyds based on trimethylolethane. When the alkyds are further improved by the High Polymer Alkyd Technique, the resulting vinyl monomer modified system show improved mar resistance, adhesion and flexibility<sup>5</sup> even over conventional TME alkyds.

Both trimethylolethane and trimethylolpropane have been considered for use in polyesters modified by isocyanates. Considerable literature exists on the German experience with these materials, particularly trimethylolpropane. In general, a polyester is prepared

from polyols and dibasic acids. This is followed by reaction with the isocyanate or its "blocked" derivative. Two formulations are indicated below for typical systems of this type for use in foamed polyurethane resins.

#### FLEXIBLE FOAMS

Trimethylolpropane	1.6
Diethylene Glycol	41.8
Adipic Acid	56.6
Hydroxyl Content	0.78%
Acid No.	1.3
Viscosity	Z
Color	2-

Charge all ingredients. Heat to 180°C. and hold for 2 hours. Increase temperature to 245°C. and hold to an acid number of less than 2.

#### FOAM PREPARATION

Polyester	39
Diethyleneethanolamine	0.16

Dow Corning Silicone 200	0.10
Water	1.8
Mix thoroughly and add Hylene TM (DuPont)	13

RIGID FOAMS	
Polyester Preparation	
TME	25.3
Emery 3065 S	63.4
Diethyleneglycol	11.3

PREPARATION  
Esterify TME Technical with dimer acids to an acid number of approximately 2 at 230°C. Add diethyleneglycol on cooling to 180°C.  
Analysis Acid No. = 2  
Hydroxyl value = 380

The above polyester shows excellent storage stability properties. A similar composition may be prepared from TMP.

(Turn to page 156)

Polyol	Glycerol (1)			TME (Eq. Phthalic) (2)			TME (Eq. Molar) (3)		
	10	20	30	10	20	30	10	20	30
% Melamine	10	20	30	10	20	30	10	20	30
Color change	XXXX	XXX	X-Gray	XX	NC	X	NC	NC	NC
Loss of Gloss	X-	X-	X-Haze	X-BLE	NC	X-	NC	NC	NC
Chalking	X-	X-	Trace Haze	X-	NC	Trace	NC	NC	NC
Checking	NC	NC	NC	NC	NC	NC	NC	NC	NC
Mildew	NC	Def.	X-Haze	NC	X-	X-	NC	NC	NC

Code  
NC = No change    BLE = Bleach    X- = Very slight    X = Slight    XX = Definite    XXX = Medium    XXXX = Bad

Table IV. Twelve Months Florida Exposure of Short Oil Lauric Alkyds Modified with Melamine Resin.

# GLYCOLS and HEXANETRIOL

By  
Victor H. Boden\*  
and  
Thomas J. Hall\*

THE alkyd and polyester fields offer a wide spectrum of application possibilities for the glycols and hexanetriol. Further, the polyester field offers much broader possibilities for these materials than does the alkyd field alone. Alkyd resins were, of course, originally simple reaction products of glycerol and phthalic anhydride. In the alkyd field the applications of glycols have to a considerable extent been restricted to formulations using mixtures of ethylene glycol and pentaerythritol in place of glycerol. The substitution of 1,2,6-hexanetriol for glycerol permits the synthesis of resins which have greater flexibility, and better resistance to weathering, than alkyds made from glycerol.

Among the polyols used in the manufacture of alkyds and polyesters, ethylene glycol and propylene glycol are of major importance. The multi-hydroxy compounds, hexanetriol and the polyethylene glycols offer interesting formulation possibilities, and are becoming of greater importance.

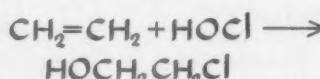
It must be emphasized that, although the glycols and other polyols are essential building blocks

for the manufacture of alkyd and polyester resins, opportunities for varying physical properties of the product resins lie largely in the choice of the acid component of the resins. Thus, in the preparation of water-emulsifiable alkyds, the desirable properties are realized by use of a system of high acid number which is neutralized with ammonia to yield an emulsifiable resin. Similarly in the preparation of 100 per cent active, or solvent-less, coatings, unsaturated acids determine the properties of the resultant polyesters which are used.

#### Manufacturing Processes

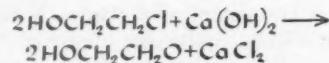
##### *Ethylene Glycol*

Ethylene glycol is made by one of two different processes. Both processes start with ethylene gas—a co-product of petroleum cracking operations. In the older process, ethylene and hypochlorous acid are reacted to form ethylene chlorohydrin.

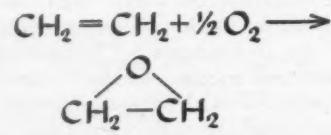


The chlorohydrin is separated from other reaction products by distillation and is reacted with an alkali,

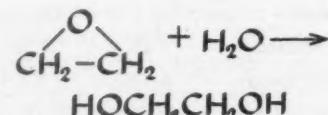
such as lime, to give ethylene glycol.



In the newer process, upon which all ethylene glycol plants now being constructed are based, ethylene is oxidized over a catalyst by air or oxygen to ethylene oxide.



The ethylene oxide is reacted with water to yield ethylene glycol.



##### *Propylene Glycol*

Propylene glycol, unlike glycol, can be made by the chlorohydrin route. (Air oxidation of propylene yields acrolein rather than propylene oxide.) Propylene from the

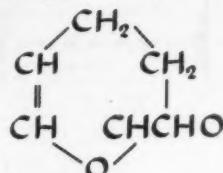
\*Union Carbide Chemicals Co., Div. of Union Carbide Corp.

dehydrogenation of propane in petroleum cracking operations is the basic raw material.

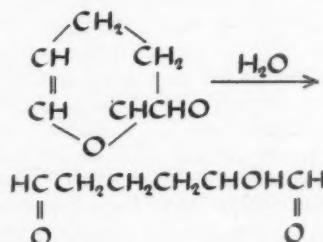
#### Hexanetriol

Hexanetriol has recently become commercially available through the development of a synthesis based on acrolein (I & E C).

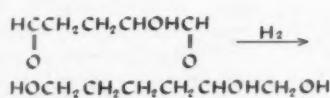
In a first, acrolein dimer is formed from acrolein:



The dimer is then hydrolyzed to 2-hydroxadipaldehyde,

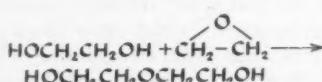


which is hydrogenated in the presence of a catalyst to give 1,2,6-hexanetriol:



#### Polyethylene Glycols

Diethylene glycol and triethylene glycol are made by the reaction of ethylene oxide and ethylene glycol. Diethylene glycol is made from one molecule of each.



Triethylene glycol is made similarly by adding two molecules of ethylene oxide to one of ethylene glycol.

#### General Properties

##### Ethylene Glycol

Ethylene glycol, is an odorless, low-volatility, hygroscopic liquid. Its physical properties are summarized in Table I. While it is not

a hazardous material as it is usually handled, ethylene glycol can cause serious injury, or even death, if swallowed.

##### Propylene Glycol

Propylene is a colorless, odorless, tasteless liquid which is completely miscible with water and with many organic solvents. Unlike ethylene glycol, propylene glycol is not harmful when taken internally.

##### Hexanetriol

1,2,6-Hexanetriol is a stable, high-boiling liquid and is completely miscible with water and acetone.

##### Polyethylene Glycols

Diethylene glycol and triethylene glycol, are colorless liquids. The diglycol is practically odorless and the triglycol has a slight sweet odor.

Recently, a polyester resin grade of diethylene glycol has been made available by Union Carbide Chemicals Company which features narrow boiling range, controlled hydroxyl content, and low ethylene glycol content.

#### Resin Formulations

##### Ethylene Glycol

Ethylene glycol reacts with dibasic acids to form alkyd-type resins. Alkyds made from ethylene glycol and phthalic anhydride are used, in conjunction with similar resins based on pentaerythritol, in the manufacture of surface coatings.

A major use of ethylene glycol in the formation of polyester resins has developed which is also of interest, although not specifically in the surface coating field. This is in

the manufacture of ethylene glycol terephthalates by the reaction of dimethyl terephthalate and ethylene glycol. These products were first produced by Imperial Chemical Industries in England under the trademark "Terylene" and are now made in the U.S. by DuPont under the trademarks "Dacron" (fibers), "Mylar" (films), and "Cronar" (photographic film base).

Other intriguing possibilities include combining ethylene glycol with some of the newer dibasic acids now becoming commercially available, such as isophthalic acid and dimer acids.

##### Propylene Glycol

Polyester resins can be made by the reaction of propylene glycol and dibasic acids, in much the same manner that ethylene glycol can be used. Propylene glycol became commercially available later than ethylene glycol, but is used extensively today—both alone and in mixtures with other glycols—in the production of polyesters.

Unsaturated polyester resins, such as those used in solvent-less coatings, can be formulated from propylene glycol. One typical formula for such a coating is:

##### Moles

	Moles
Propylene glycol	2.2
Phthalic anhydride	1.0
Maleic anhydride	1.0

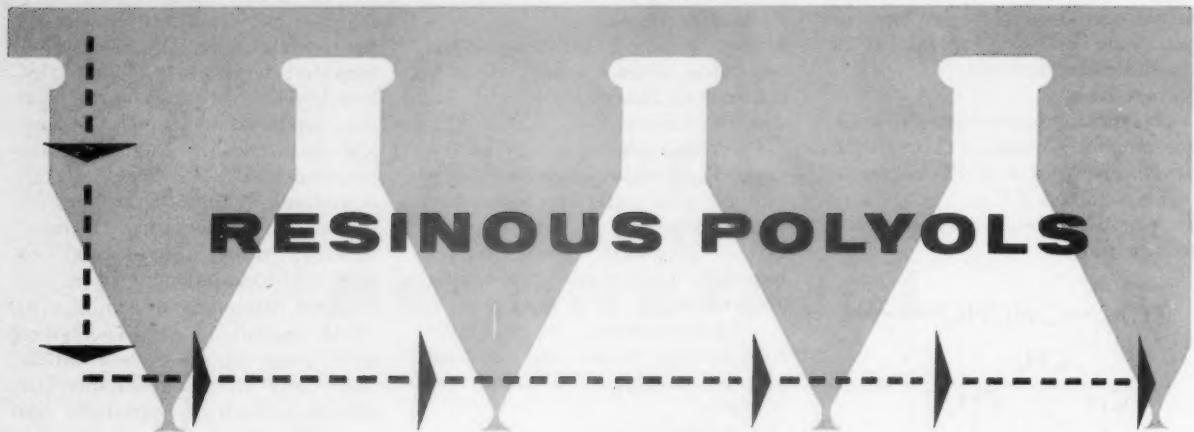
Simple as this formulation appears, the actual formulation and manufacture of such unsaturated polyester resins are complex operations. The exact choice of reactants (Turn to page 162)

Property	Ethylene Glycol	Propylene Glycol	Hexanetriol	Diethylene Glycol	Triethylene Glycol
Molecular weight	62.07	76.10	134.18	106.12	150.18
Specific gravity 20/20°C.	1.1155	1.0381	1.1063	1.1184	1.1255
Boiling point, °C., 760 mm.	197.5	188.3	178 (5 mm.)	244.8	287.4
Vapor pressure, mm. Hg @ 20°C.	0.05	0.07	<0.01	<0.01	<0.01
Freezing point, °C.	-13.0	—	+32.8*	-8.0	-4.3
Solubility, % by wt. @ 20°C., in water water in	Complete	Complete	Complete	Complete	Complete
Pounds per gal. @ 20°C.	9.3	8.6	9.2	9.3	9.9
Flash point, °F., open cup tester	240	225	375	290	320

\*Under carefully controlled conditions. Usually sets to a glass below -20°C.

Table I. Physical properties of glycols and hexanetriol.

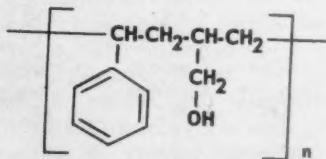
# RESINOUS POLYOLS



**I**N the field of polyols, two resinous types are currently available which have use in alkyd resins. By and large both of these resinous polyols are used to supplement conventional polyols such as glycerine and pentaerythritol synthesis. Such modifications are claimed to improve film properties or impart special film characteristics.

### Polyol X-450

Resinous Polyol X-450, developed by the Shell Chemical Corp., is a hard, resinous polyhydric alcohol exhibiting high primary hydroxyl functionality. It is being offered in development quantities. X-450 is finding use as a polyol for the preparation of simple esters of fatty acids which provide vehicles with unique properties.



Basic structural formula for Polyol X-450.

This article was prepared by the Editorial Staff of Paint and Varnish Production.

### Properties

Evaluation for Resinous Polyol X-450 has revealed the following properties: Exceptionally light color which is also present in the esters and alkyds; rapid esterification to a low acid number; and free flowing, hard resin with a high softening point which does not degrade at cooking temperatures. When cured with urea resin for 10 minutes at 400°F., this polyol is also said to yield hard films which have good resistance to methyl isobutyl ketones.

### Ester Preparation

In the preparation of Polyol X-450 esters, it is recommended that a stoichiometric balance of polyol and organic acid be used. The basis for the calculation is the equivalent weight of the polyol (222) and vary the acid equivalents from 0.3 to 0.8, dependent upon the desired "oil" content. Unlike other polyhydric alcohols, large excesses of hydroxyl are not harmful.

Resinous Polyol X-450 esters may be cooked in open or closed kettles using the azeotropic or fusion methods. Temperatures up to 525°F. are recommended since there are no volatile components.

A typical laboratory preparation

of the dehydrated castor ester is illustrated as follows:

Reactor Charge	% Wt. (Solids)
Resinous Polyol	

X-450, 214 g	58
--------------	----

Dehydrated Castor	
-------------------	--

Acids, 155 g	42
--------------	----

Xylene, 100 ml	
----------------	--

The reactants are charged to a one-liter, four-neck kettle fitted with a thermometer well, stirrer, nitrogen inlet tube, and Dean-Stark condenser trap. The mixture is heated by means of an electric heating mantle. Stirring is commenced at about 200°F. The temperature is raised to 480°F. during the first hour and held there for four-hours, by which time the acid number has dropped to four. The mixture is then cooled and thinned with mineral spirits (KB Value = 43).

### Vehicle Constants

Non-Volatile Vehicle	47%
----------------------	-----

Viscosity, Gardner-Holdt	F
--------------------------	---

Color, Gardner	2
----------------	---

Solvent	Mineral Spirits
---------	-----------------

Acid Number, on Solids	4
------------------------	---

TYPE OF MATERIALS	1 MIL FILM - FORCE DRIED 30 MIN. @ 200°F - RESINOUS POLYOL X-450		
	90%w	50%w	10%w
Linseed Oil (Z Bodied)	—	—	—
Alkyd Resin, Short Coconut	—	—	—
Alkyd Resin, Medium Soya	—	—	—
Alkyd Resin, Long Soya	—	—	—
Alkyd Resin, Short DCO	C	C	C
Urea-Formaldehyde Resin	C	C	C
Melamine-Formaldehyde Resin	C	C	C
Phenolic	C	C	C
Rosin Modified Phenolic	C	C	C
Chlorinated Aromatic	C	C	C
Ester Gum	C	C	C
Rosin Esters	C	C	C
Wood Rosin	C	C	C
Polymerized Rosin	C	C	C
Hydrogenated Rosin	C	C	C
Rosin Alcohol	C	C	C
Cellulose Nitrate RS-1/2 Sec.	—	—	—
Polyvinyl Acetate	—	—	—
Polyvinyl Acetate Chloride	—	—	—
Chlorinated Rubber	—	—	—
Alkyd Resin, Non-Drying	C	C	C
Alkyd Resin, Med. Castor	C	C	C
Orange Shellac	C	C	C

I = Incompatible  
C = Compatible

Table I. Compatibility of X-450 with coating materials.

Vehicle properties of Resinous Polyol X-450 esters include low viscosity giving high film build at high solids; tolerate low cost solvents; and can be styrenated with as much as 67% styrene without gelation. Film properties claimed are high gloss; excellent alkali resistance; excellent gloss retention upon weathering; good water resistance, and good color retention in ultra-violet exposure.

Soya esters, dehydrated castor esters, dehydrated castor esters with urea resin in baked finishes, coconut esters with melamine resin in baked finishes, and tall oil esters can be formulated with Resinous Polyol X-450.

#### X-450 in Alkyds

Alkyds, utilizing this polyol, can be made by conventional techniques. Sufficient excess hydroxyl (25-30%) to insure adequate cure with amino resins is recommended.

A typical non-drying type alkyd made with X-450 is as follows:

Charge - X-450	40.0% wt.
Phthalic Anhydride	16.4
Glycerine	9.6
Coconut Acids	34.0

Cook the above for one hour at 400°F. then one hour at 482°F. Cool and dilute with xylene, filter.

Another alkyd system for top-coat work has the following composition:

X-450	17.5% wt.
Glycerine	17.2

Phthalic Anhydride 28.2  
Lauric Acid 29.5  
p. tertiarybutylbenzoic acid 7

This resinous polyol offers the manufacturer of vehicles a specialty product designed for synthesis of alkyds and esters for formulating protective coatings with a variety of good film properties.

#### RESINS 565

Dow Resin 565, manufactured by the Dow Chemical Co., is a high molecular weight dihydric alcohol and a technical grade of the diether of propylene glycol and Bisphenol A. The chemical name is 1, l'isopropylidenebis (p-phenyleneoxy) di-2-propanol. The idealized structural formula is proposed in Figure 1.

As its structure suggests, this polyol resin can be considered a glycol. However, its high molecular weight and structure contribute new properties not exhibited by common glycols.

The phenolic reactivity of Bisphenol A is not experienced with 565. It is claimed that etherification of the phenolic hydroxyls has eliminated the usual phenolic problem of poor color retention. The

resulting ether bonds is said to provide polarity favorable to good adhesion of surface coatings.

#### Properties

Dow Resin 565 is a highly viscous amber liquid having the following physical properties: Combining weight in esterification—189 max.; viscosity (60°C., in centipoises)—1,250 ± 200; volatility (% gloss at 175°C. and 10mm. Hg, 1 hr.)—1.0 max.; Color, Gardner—5-9; phenolic hydroxyl as % phenol—0.3 max.; density (60°/4°C.)—approx. 1.85; lbs./gallon—9.04; refractive index—approx. 1.542; and color stability toward heat or light—good.

This resinous polyol is easily soluble at room temperature in most aromatic or polar solvents. Examples of such commonly used solvents include: Aromatics like xylene and toluene; alcohols similar to methyl, n-butyl and ethylene glycol; and ketone or ester solvents such as acetone, methyl ethyl ketone, and ethyl acetate. It also possesses limited solubility in less polar materials such as mineral spirits, drying oils, and glycerine.

#### Use in Alkyds

The primary use for Resin 565 is in the field of alkyd resins. This intermediate esterifies with dibasic and drying oil acids in combination with other highly functional polyalcohols. The resulting alkyd polymers are said to be exceptionally durable.

The single use of highly functional polyols such as pentaerythritol has been limited to longer oil alkyds. Excessive viscosity and the possibility of gelation exist in shorter oil alkyds of high functionality.

Replacing some of the highly functional polyols with Dow Resin 565 has the effect of reducing the alkyd complexity. Widely spaced, flexible, linear esters of high molecular weight result.

Pentaerythritol was chosen as a typical, highly functional polyalco-

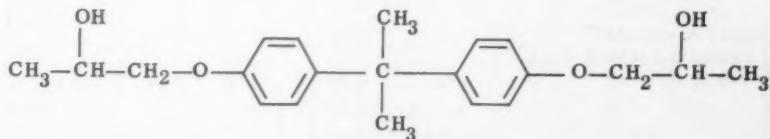


Figure 1.

Ingredients:										
Oil Type	Soya	Soya	Soya	Linseed	Linseed	Dehydrated Castor Oil	Tall Oil*	Soya	Soya	
% Oil	30	40	50	40	50	50	50	50	50	30
% Dow Resin 565	31	22	11	22	11	18	16	18	18	11
% Pentaerythritol	9	10	11	10	11	8	13	8	5	5
% Phthalic Anhydride	30	28	28	28	28	24	21	--	14	14
% Isophthalic Acid	--	--	--	--	--	--	--	24	--	--
% Vinyltoluene	--	--	--	--	--	--	--	--	40	40
Final Acid Value (Solids):	21	18	21	16	16	18	21	13	10	
Solution Properties:										
Solvent	Xylene	MS:4 Xylene:1	MS	MS:4 Xylene:1	MS	MS	MS	MS	MS	MS
Solids	60%	50%	60%	50%	60%	50%	60%	60%	60%	60%
Gardner Viscosity	T	Z	W	Y	Z-4	Z-3-4	Q	Z-4-5	Z	
Gardner Color	7-8	7	7	7	7	6-7	8-9	6	6	
% Solids at "G-H" Viscosity	50%	38%	49%	45%	42%	29%	52%	40%	45%	

\*Tall oil, containing 25% rosin

hol to supplement Dow Resin 565 in the examples described in Tables I and II.

A wide choice of vehicle and film properties can be obtained with Dow Resin 565, pentaerythritol, phthalic anhydride, and oil system included in Tables II and III. At every oil length, an optimum ratio of Dow Resin 565 to pentaerythritol exists. Longer oil alkyds may require a slightly higher pentaerythritol content to assure fast through-dry and hardness. Very short oil alkyds with moderate to fast dry can be prepared if the pentaerythritol content is lowered as Resin 565 content increased. However, 565, like other glycols,

will contribute very slow drying rates if used in excessive amounts in alkyd formulations. At any oil length, Dow Resin 565 alkyds can be expected to provide good durability, flexibility, and color retention.

Dow Resin 565 alkyds can be monomer modified for certain advantages with styrene and vinyltoluene.

In addition to exhibiting the good adhesion, solubility, and compatibility common to most alkyd resins, Dow Resin 565 modified alkyds possess the following specific advantages: Exterior exposure durability; alkali resistance; color retention; and flexibility.

Table II. Examples of alkyd vehicles containing Dow Resin 565.

Oil Type	Soya	Soya	Soya	Linseed	Linseed	Dehydrated Castor Oil	Tall Oil	Soya	Soya
Oil Length	30	40	50	40	50	50	50	50	30
Dry Time*									
To touch (hours)	1/2	1/2	7	1/3	3-1/2	1/3	3-1/2	2-1/2	1/4
Foil-free (hours)	< 15	8	< 15	5	7	< 15	12	24	1/2
Sward Rocker Hardness*									
24 Hours	33	27	18	42	39	27	21	14	47
3 Days	37	36	24	52	49	35	29	16	47
7 Days	40	40	26	52	49	37	34	18	53
Alkali Resistance**									
(Hours to failure in 3% NaOH)	120	72	38-48	176	176	52	20	8-12	120
Flexibility**									
1/4" Mandrel	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Fail
1/8" Mandrel	Fail	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Fail
Impact Resistance**									
Falling ball method--back side (in. in. /lbs.)	6	> 30	> 30	> 30	> 30	> 30	> 30	> 30	2

\*All tests on films containing 0.04% Co. and 0.4% Pb. driers (metal/vehicle solids)

\*\*Films dried at 250°F. for 30 min. approximate film thickness: 1.0 mil

## POLYOL SUPPLIERS

### GLYCERINE

Archer-Daniels-Midland Co.  
Armour and Co.  
Beach Soap Co.  
Colgate-Palmolive Co.  
Dow Chemical Co.  
E. F. Drew and Co.  
Glycerine Corp. of America  
Harchem Div., Wallace & Tiernan  
Harshaw Chemical Co.  
Lever Brothers Company  
Mallinckrodt Chemical Works  
Pacific Soap Co.  
Procter and Gamble Co.  
Reichhold Chemicals  
Shell Chemical Corp.  
Solvents and Chemical Group  
Swift and Co.  
Vopcolene Div., Emery Industries, Inc.

### GLYCOLS

*Ethylene Glycols*  
American Mineral Spirits Co.  
Antara Chemical Div.  
R. J. Brown Co.  
Dow Chemical Co.  
Enjay Co.  
Jefferson Chemical Co.  
Olin Mathieson Chemical Corp.  
Union Carbide Chemical Co.  
Wyandotte Chemical Corp.

*Polyethylene Glycols*  
R. J. Brown Co.  
Dow Chemical Co.  
Jefferson Chemical Co.  
Nopco Chemical Co.  
Olin Mathieson Chemical Corp.  
Union Carbide Chemical Co.

*Propylene Glycol*  
American Mineral Spirits Co.  
R. J. Brown Co.  
Celanese Corp. of America, Chemical Div.  
Dow Chemical Co.  
Union Carbide Chemicals Co.  
Wyandotte Chemicals Corp.

**HEXANETRIOL**  
Union Carbide Chemical Co.

**METHYL GLUCOSIDE**  
Corn Products Refining Co.

**PENTAERYTHRITOL**  
Borden Co., Chemical Div.  
Celanese Corp. of America  
Commercial Solvents Corp.  
Delaware Chemicals  
Gulf Oil Corp., Petrochemicals Dept.  
Hercules Powder Co.  
Heyden-Newport Chemical Corp.  
Reichhold Chemicals, Inc.  
Trojan Powder Co.

**RESINOUS POLYOLS**  
Dow Chemical Co.  
Shell Chemical Corp.

**SORBITOL**  
Atlas Powder Co.  
Merck & Co.

**TRIMETHYLOLETHANE**  
Heyden-Newport Chemical Corp.  
Trojan Powder Co.

**TRIMETHYLOLPROPANE**  
Celanese Corp. of America, Chemical Div.  
Heyden-Newport Chemical Corp.  
Trojan Powder Co.

### ADDRESSES

American Mineral Spirits Co.  
Mountain View  
Murray Hill, N. J.

Antara Chemical Div.  
435 Hudson St.  
New York, New York

Archer-Daniels-Midland Co.  
Chemical Products Div.  
700 Investors Bldg.  
Minneapolis, Minn.

Armour and Company  
1355 W. 31st  
Chicago 9, Ill.

Beach Soap Co.  
125 Lawrence St.  
Lawrence, Mass.

Borden Co.  
Chemical Div.  
350 Madison Ave.  
New York, N. Y.

R. J. Brown Co.  
1418 Wittenberg Ave.  
St. Louis, Mo.

Celanese Corp. of America  
Chemical Div.  
180 Madison Ave.  
New York, N. Y.

Colgate-Palmolive Co.  
300 Park Ave.  
New York, N. Y.

Commercial Solvents Corp.  
260 Madison Ave.  
New York, N. Y.

Corn Products Refining Co.  
17 Battery Pl.  
New York, N. Y.

Delaware Chemicals, Inc.  
P. O. Box 1772  
Wilmington, Del.

Dow Chemical Co.  
Midland, Mich.

E. F. Drew and Co.  
15 E. 26th St.  
New York, N. Y.

Enjay Co.  
15 W. 51st St.  
New York, N. Y.

Glycerine Corp. of America  
36 W. 44th St.  
New York, N. Y.

Gulf Oil Corp.  
Petrochemicals Dept.  
P. O. Box 1166  
Pittsburgh 30, Pa.

Harchem Div.  
Wallace & Tiernan, Inc.  
25 Main St.  
Belleville 9, N. J.

Harshaw Chemical Co.  
Railroad Ave.  
Hastings, N. Y.

Hercules Powder Co.  
Wilmington, Del.

Heyden-Newport Chemical Corp.  
342 Madison Ave.  
New York, N. Y.

Jefferson Chemical Co.  
260 Madison Ave.  
New York, N. Y.

Lever Brothers Company  
390 Park Ave.  
New York, N. Y.

Mallinckrodt Chemical Works  
Second and Mallenckrodt Sts.  
St. Louis, Mo.

Merck & Co.  
Rahway, N. J.

Nopco Chemical Co.  
Harrison, N. J.

Olin Mathieson Chemical Corp.  
Mathieson Bldg.  
Baltimore, Md.

Pacific Soap Co.  
6830 McKinley Ave.  
Los Angeles, Calif.

Procter & Gamble Co.  
Sixth & Sycamore Sts.  
Cincinnati 2, Ohio

Reichhold Chemicals, Inc.  
525 N. Broadway  
White Plains, N. Y.

Shell Chemical Corp.  
380 Madison Ave.  
New York, N. Y.

Solvents and Chemicals Group  
2540 Fluroney St.  
Chicago, Ill.

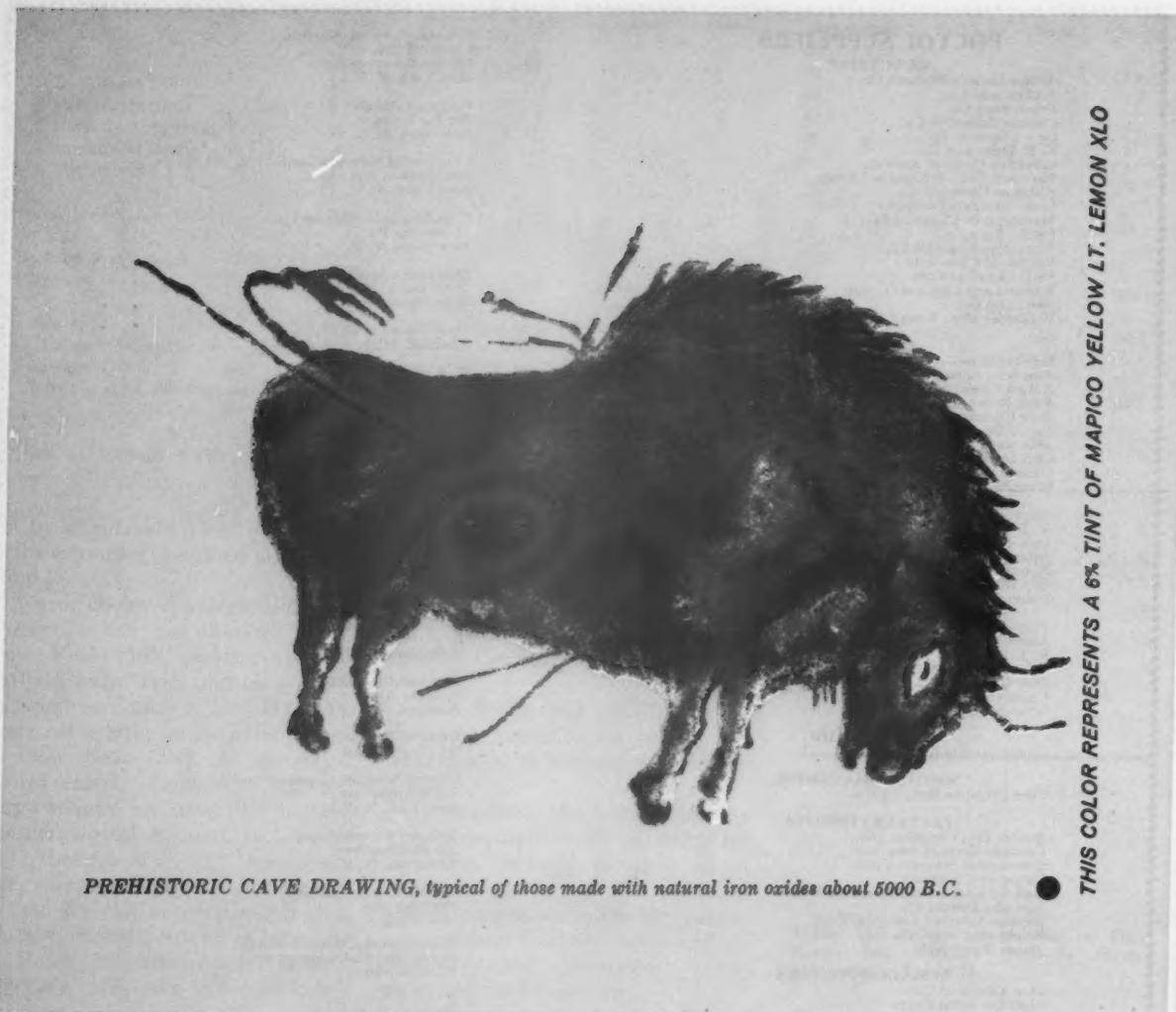
Swift and Co.  
Union Stock Yards  
Chicago 9, Ill.

Trojan Powder Co.  
17 N. 7th St.  
Allentown, Pa.

Union Carbide Chemicals, Co., Div. of Union  
Carbide Corp.  
30 E. 42nd St.  
New York, N. Y.

Vopcolene Div.  
Emery Industries, Inc.  
5568 E. 61st  
Los Angeles, Calif.

Wyandotte Chemicals Corp.  
Wyandotte, Mich.



*PREHISTORIC CAVE DRAWING, typical of those made with natural iron oxides about 5000 B.C.*

# PERMANENCE

## MAPICO COLORS

Yellows  
Tans  
Reds  
Browns  
Black

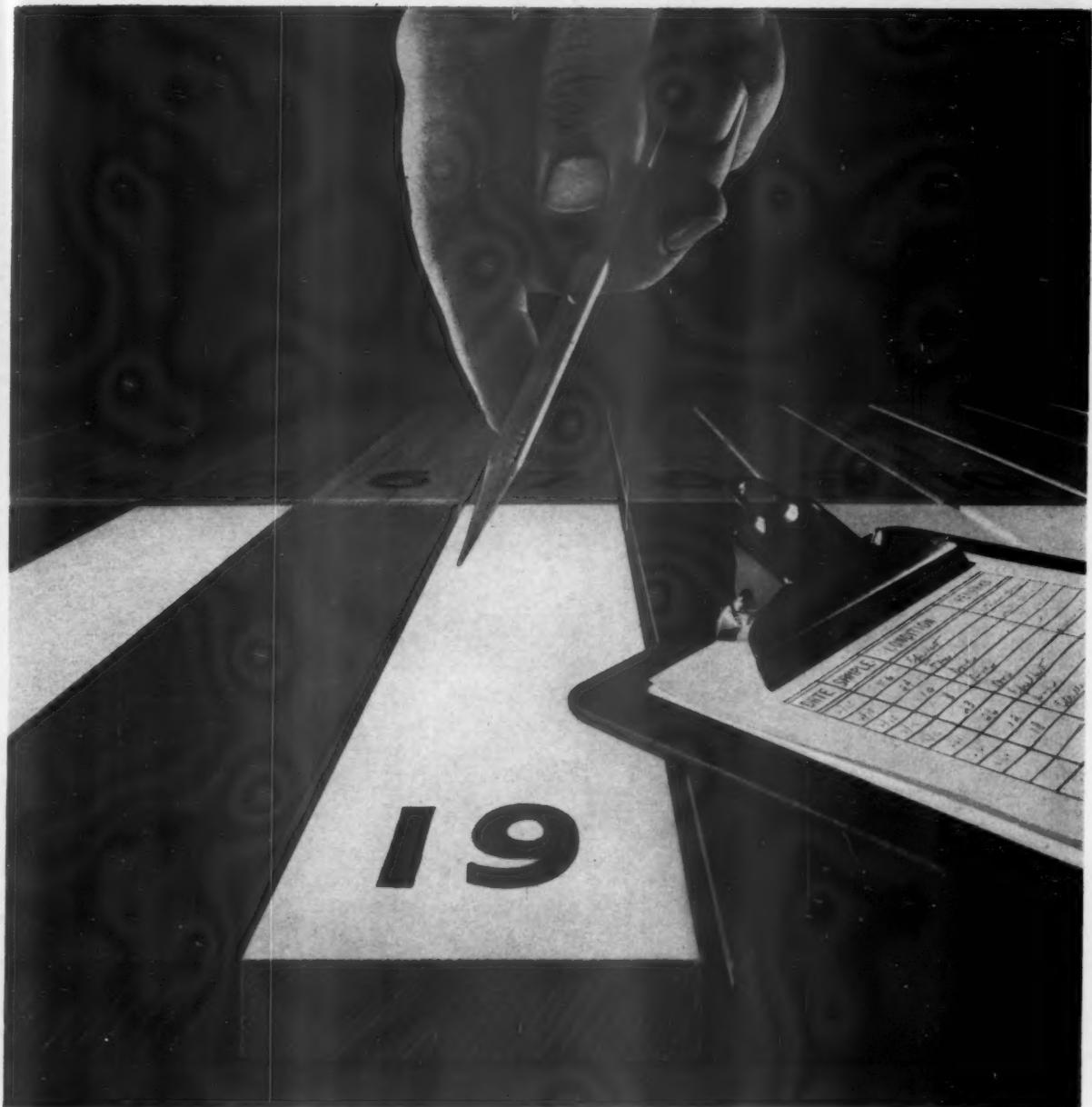
For utter permanence . . . extreme color fastness . . . Mapico synthetic colors easily equal or surpass the natural iron oxides used by cavemen in prehistoric times.

In addition, modern Mapico iron oxides—synthetically produced under rigidly regulated processes—are alkali fast and act as effective UV screening agents . . . both vital considerations in formulating coatings that will meet the stringent requirements of this satellite age.

Other advantages of Mapico colors over natural oxides: superior hiding power, freedom from abrasion, far greater uniformity and tinting strength.

**COLUMBIAN CARBON COMPANY**  
380 Madison Avenue, New York 17, N.Y.

**PRODUCERS OF COLUMBIAN COLLOIDS:**  
synthetic iron oxide pigments, carbon black, carbon black dispersions



## **Vinyltoluene upgrades quality of your paints and varnishes at lower cost**

Vinyltoluene from Dow forms clear, useful vehicles with all commercially important drying oils. This is due to its unusual ability to modify such drying oils as dehydrated castor, linseed, safflower, soya, menhaden, cottonseed, coconut or tall oil.

As a result, you are offered a wide selection of inexpensive vehicles which help improve your paints and varnishes sub-

stantially. For instance, they are more uniform. They are also easier to apply; retain higher gloss; are more flexible; adhere better to surfaces; and they last longer. Yet, thanks again to Dow vinyltoluene, they cost you less to produce.

For more information, contact our nearest sales office. Or write THE DOW CHEMICAL COMPANY, Midland, Michigan, Coatings Sales Dept. 2203B-2

**YOU CAN DEPEND ON**





Highland Alameda County Hospital, Oakland, California. Painting Contractor: Pacific Painting and Decorating, Berkeley, Calif.

## Exterior latex paint gets the big jobs

When it came to painting the 350,000 square-foot stucco exterior of this California hospital, styrene butadiene latex paint got the job. And for good reasons!

Latex paints have proved on thousands of jobs that they combine *all* the qualities of an ideal masonry paint. They dry to a tough, durable film that weather won't harm. They resist alkali and staining. And they eliminate blistering and peeling because they let masonry breathe. Moreover, latex paints are easy to apply, dry quickly and cut clean-up time

to a minimum. They speed up every step of the job.

All these benefits with *one* formulation! You offer nothing but the best when you put your brand name on exterior masonry paints made with Dow Latex. They get the *big* jobs . . . and the smaller ones too! THE DOW CHEMICAL COMPANY, Midland, Michigan, Coatings Sales Department 2124J-1.

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SEE THE DIFFERENCE

**DOW EPOXY RESIN  
65% SOLIDS  
. in 50/50  
MIBK/XYLENE**

DOW 50

## SYNTHETIC RESIN PROPERTIES

EPOXY RESIN TYPE	LR. 661	D.E.R. 664	D.E.R. 667
Epoxide Equiv. Wt.	675-575	675-985	1600-2000
mpc. (°C.)	74-100°C.	95-103°C.	120-128°C.
mpm. (°C.)	2 maximum	1 maximum	
mpm. (°C.)	1,183	1,180	
mpm. (°C.)	.14	.14	
mpm. (°C.)	<10	<10	

**COMPETITIVE EPOXY RESIN  
65% SOLIDS  
in 50/50  
MIBK/XYLENE**

For "clear" look at specification card, write to Dow.

## **"Pure" and "Clear" describe new Dow solid epoxy resins**

The visibility test shown above vividly illustrates the clarity, purity and uniformity of Dow Epoxy Resin 667, one of three new solid epoxy resins developed by Dow.

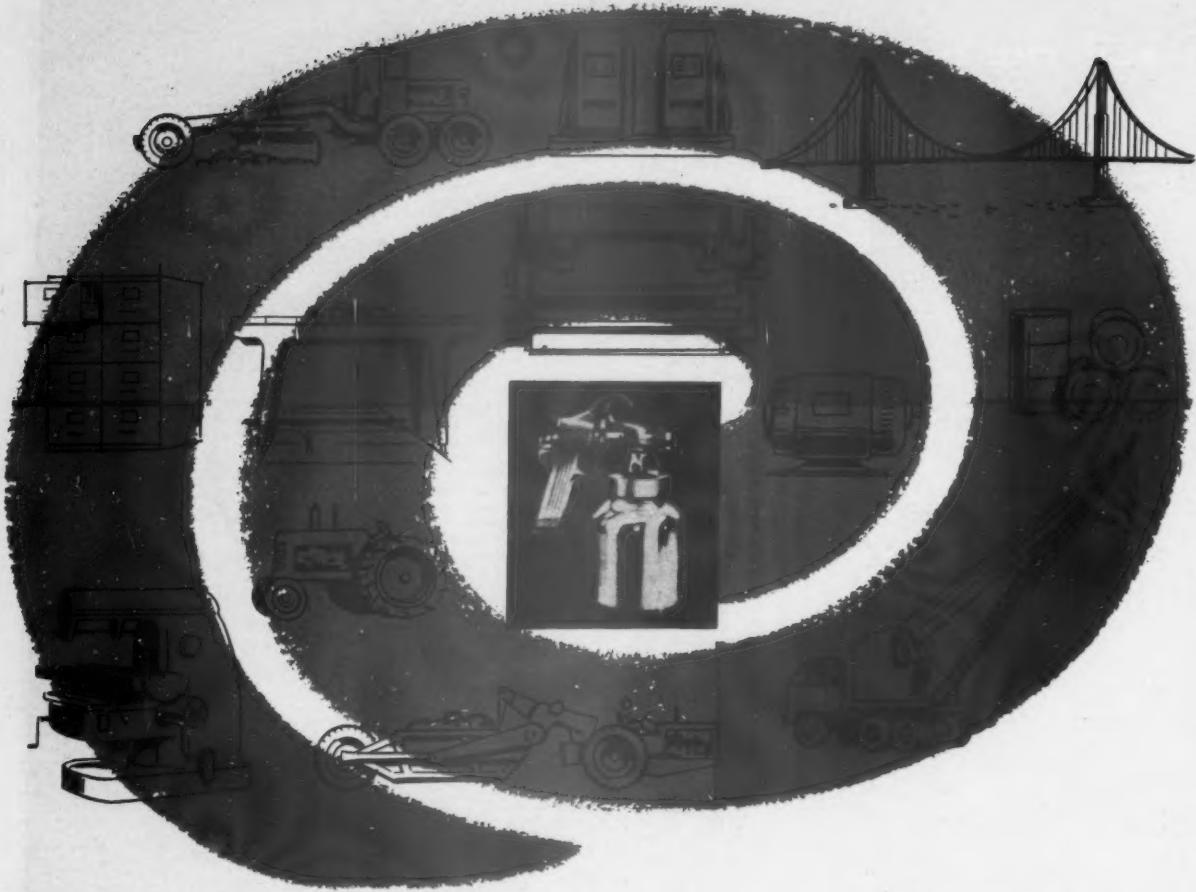
The unique advantages of D. E. R.\* 661, 664 and 667 are: (1) Nearly water-white color. (2) No need for filtering after cutting because these resins are free from salt and any small insoluble gel particles often found in standard solid epoxy resins. (3) Sodium content that is under 10 P.P.M. (4) And D. E. R. 661 is easier to handle and dissolve in solvents; it has a higher melting point so when flaked has

less tendency to fuse in warm weather.

These properties are possible because Dow is a basic producer of epoxy raw materials and is able to assure quality control and a narrower range of specifications. For more technical data on Dow Solid and Liquid Epoxy Resins contact your local Dow sales office or write THE DOW CHEMICAL COMPANY, Midland, Michigan, Coatings Sales Department.

2255K.2

**YOU CAN DEPEND ON**



## Great advance in "air-dry" paint quality at no cost premium with new Isophthalic based resins

With Oronite's superior new raw material, Isophthalic, years of extra service can be added to your metal surface coatings. Stronger film to metal bonding, outstanding film flexibility and better gloss retention of Isophthalic based coatings means improved paint performance. The tougher Isophthalic based films also have greater abrasion resistance, hold up far better under severe weather exposure, are more resistant to chemical and industrial fumes.

**DEMONSTRATION—FORMULATIONS—PROOF.** Let Oronite or your resins supplier show you how Isophthalic based resins can benefit the coatings you use. Oronite field representatives can demonstrate to you the superior properties of Isophthalic resin coatings—whatever your product requirements. Just contact the Oronite office nearest you.



**ORONITE CHEMICAL COMPANY**

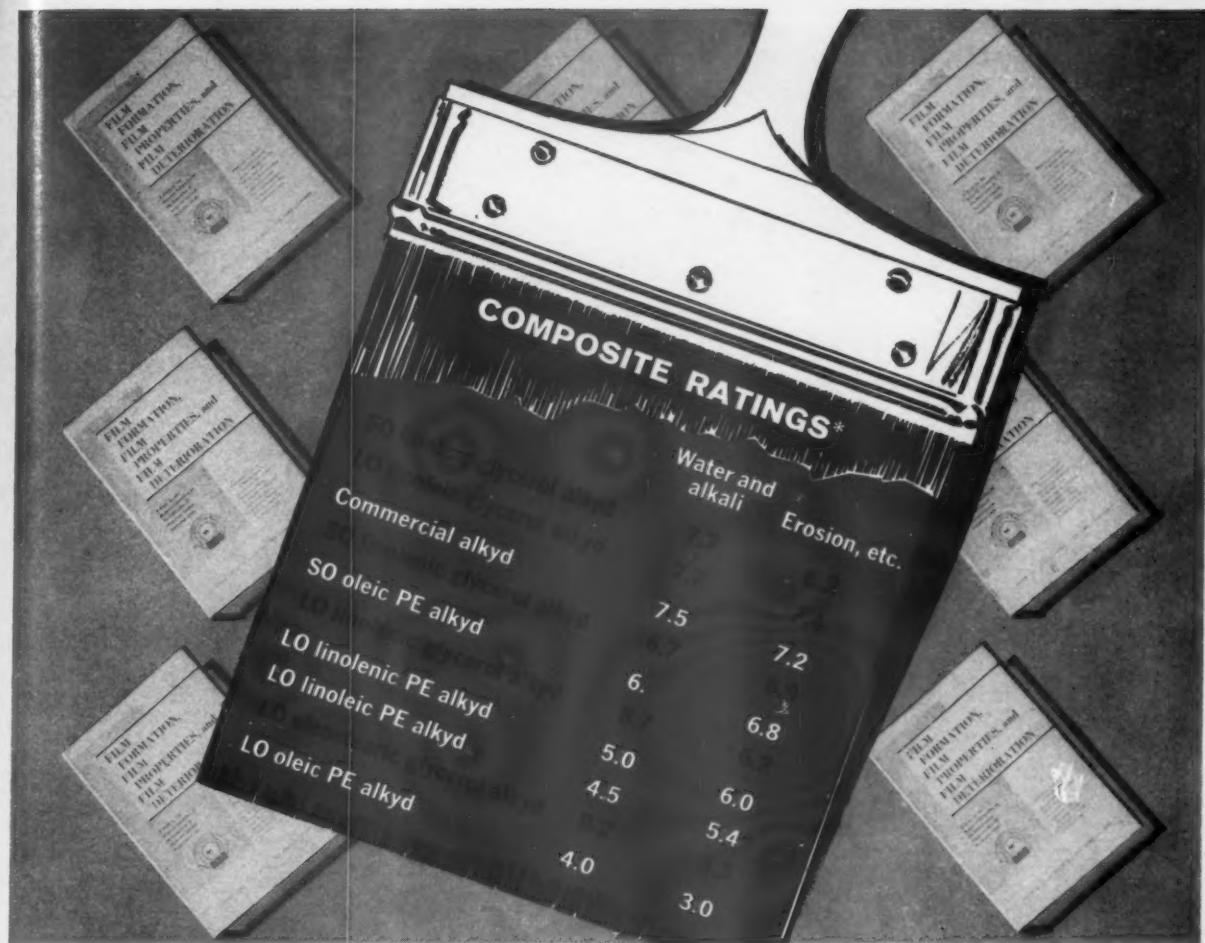
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4094



## Glycerol alkyds again achieve top ratings

The composite ratings above are fresh evidence of the importance of Glycerine in alkyd resins for paints. They appear in the recently published book, "Film Formation, Film Properties, and Film Deterioration." Judge them for yourself:

Values in the column at right are a composite of figures assigned to gloss, appearance (chalking and failure), loss in weight, hardness and abrasion resistance.

\*From page 394, *Film Formation, Film Properties, and Film Deterioration, A Study by the Research Committee of the Federation of Paint and Varnish Production Clubs.*

Values in the column at left are combined quality ratings from water and alkali immersion tests.

Glycerine has manufacturing as well as filming advantages. Its structure simplifies cooking. Its liquid state simplifies handling. We'd like to send you our 20-page booklet: "Glycerine Terms, Tests and Technical Data." Address your request to the Glycerine Producers' Association.

**Properties**

- HYGROSCOPICITY • STABILITY
- SOLVENT POWER • VISCOSITY
- NONVOLATILITY • NONTOXICITY
- TASTE • COMBINING WEIGHT



**Applications**

- HUMECTANT • CARRIER
- SOLVENT • LUBRICANT
- SOFTENER • EMOLlient
- ANTI-FREEZE • ALKYD BASE

GLYCERINE PRODUCERS' ASSOCIATION • 295 MADISON AVENUE, NEW YORK 17, N. Y.



RHOPLEX film being tested on the Instron tester.

## Rhoplex AC-33 . . . Tough Films for Tough Paints

This tough, flexible film being tested upon this Instron tester can be stretched, twisted, bent, compressed, exposed to heat and ultraviolet light, and dipped in calcium hydroxide solution—yet not break down. The film is made from nothing but pure RHOPLEX AC-33 100% acrylic emulsion—there are present no plasticizers, no stabilizers, no additives of any nature.

The toughness and extensibility of this film are evident in exterior emulsion paints made with RHOPLEX AC-33. Also evident is the exceptional durability that RHOPLEX AC-33 adds to paints. On houses, hotels and factories in the U.S. and 32 foreign countries, paints based on RHOPLEX AC-33 have successfully withstood the test of over four and one-half years of exposure. Furthermore, these paints have excellent adhesion to a variety of surfaces . . . are easy to apply by brush, spray or roller . . . dry so rapidly that two coats can be applied

within an hour . . . resist water spotting and can be scrubbed . . . give off no objectionable "painty" odor.

Why not investigate these advantages of RHOPLEX AC-33 for your paints?

RHOPLEX is a trade-mark, Reg. U.S. Pat. Off. and in principal foreign countries.



Chemicals for Industry  
**ROHM & HAAS**  
**COMPANY**

THE RESINOUS PRODUCTS DIVISION  
 Washington Square, Philadelphia 5, Pa.

Representatives in principal foreign countries

# RHOPLEX AC-33

# SHIRT SLEEVE HELP FOR RESIN MAKERS



**I**F YOU'RE just beginning to manufacture alkyd resins—or an "old-hand" producer with some production problems still unsolved—Pittsburgh's Technical Service Department may be of real service to you.

As a dependable source of phthalic anhydride, maleic anhydride and fumaric acid, we're well experienced—and ready—to assist you with your application problems.

This help goes well beyond "samples and data sheet" on our products—which are always available, of course. We'll be glad to make up sample resins, suggest formulations for your special requirements, and recommend sound processing procedures. And, when the problem calls for it,

our engineers are at your service for a troubleshooting meeting at your plant. Pittsburgh is *not* a commercial resin producer.

What's your alkyd resin production problem? We'd like to help you lick it. *Call or write us the details today.*



WSW 6974

## PITTSBURGH CHEMICALS FOR THE PAINT INDUSTRY

Phthalic Anhydride Maleic Anhydride Furamic Acid  
Benzol Toluol Xylol Butyl Oleate Phthalocyanines

COAL CHEMICALS • PLASTICIZERS • PROTECTIVE COATINGS • ACTIVATED CARBON • COKE • CEMENT • PIG IRON

# WITCO'S PHTHALIC PLANT NEARS COMPLETION!

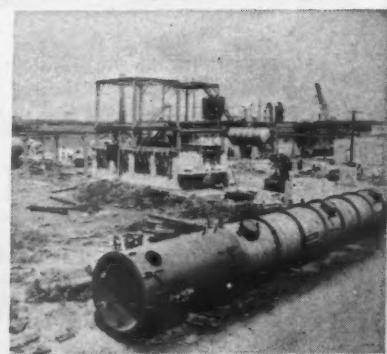
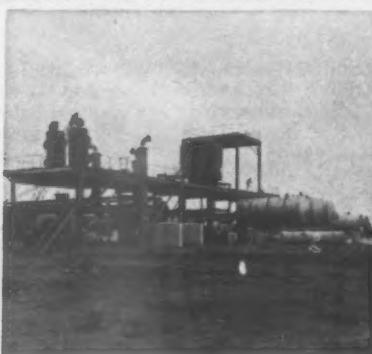
Construction work continues as fast as possible on Witco's new phthalic plant. Structural steel, tanks, reactors, columns will soon be all in place, and the most modern quality control equipment is being installed. When it's on stream in early 1959, Witco's new plant will provide 20,000,000 lbs. annually of highest quality phthalic.

WITCO  
MEANS QUALITY IN  
PHTHALIC ANHYDRIDE



*Design and Construction by Scientific Design Co., Inc.*

SECTIONS OF PLANT BEGIN TO SHAPE UP....



**WITCO CHEMICAL COMPANY, INC.**  
122 East 42nd Street, New York 17, N. Y.



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# PROGRAM

## 36th FEDERATION ANNUAL MEETING

### SUNDAY, OCTOBER 5

9:00 A.M. Meetings of the Program and Host Committees  
 10:30 A.M. Club Council Representatives Caucus  
 1:30 P.M. Federation Council Meeting  
 7:00 P.M. Committee Meetings

### MONDAY, OCTOBER 6

10:00 A.M. Meeting Opens in Public Auditorium Ball Room  
 Invocation—Verne C. Bidlack  
 In Memorium—E. L. Gott, Chairman of Memorial Committee  
 Greetings and Introductions—Dr. Joseph W. Tomecko, President of the Federation, Dr. L. R. Hickson, Oil and Colour Chemists Assoc. Welcome—Eugene H. Ott, Chairman of Host Committee  
 10:40 A.M. "Some Film Properties of Partially Compatible Systems"—Cleveland Club  
 11:00 A.M. "Use of the Gas-Phase Chromatograph in Solvent Problems"—Baltimore Club  
 11:20 A.M. "The Evaporation of Solvents From Coatings: I—Method of Measurement"—New York Club.  
 11:40 A.M. Keynote Address—"Indians, Ingenuity, and Insurance"—Dr. Lincoln R. Thiesmeyer, President of the Pulp and Paper Research Institute of Canada  
 2:00 P.M. "Rapid Determination of the Metal Content of Paint Driers"—Chicago Club  
 2:20 P.M. Address by Joseph F. Battley, President of the National Paint, Varnish and Lacquer Association  
 2:40 P.M. "Space Coatings"—Dr. L. F. Drummetter, Jr., Head, Radiometry Branch 11, Optics Division, U.S. Naval Research, Washington  
 3:20 P.M. Panel Discussion—"Pigment Dispersion"

### TUESDAY, OCTOBER 7

9:00 A.M. "The Influence of Solvent Composition on the Flow Properties of Paint"—E. C. Larson and W. W. Reynolds. (A Room Award Competition Paper)  
 9:30 A.M. Panel Discussion—"New Developments in Epoxy and Urethane Coatings"  
 11:00 A.M. "Pigment Optical Behavior—Evaluation on a Physical Basis"—F. B. Mittor and L. S. White. (A Room Award Competition Paper)  
 11:30 A.M. The Annual Joseph J. Mattiello Memorial Lecture—"In Pursuit of an Ideal"—Dr. Eugene G. Rochow, Professor of Inorganic Chemistry, Harvard University

### WEDNESDAY, OCTOBER 8

9:00 A.M. The Paint Research Institute—Dr. F. C. Weber, Jr., President  
 "The 1958-59 Paint Research Institute Program" and "Adhesion"—Dr. J. S. Long, Director of PRI  
 "Film Thickness on Structural Steel"—G. G. Schurr, Chairman of Federation's Corrosion Committee, and Dr. Wouter Bosch, Coordinator  
 "Synthesis of Uniform Latexes for Paint Formulation"—Dr. E. G. Bobalek, Case Institute of Technology  
 "Repainting of Chalked Surfaces With Emulsion Paints"—Dr. F. R. Kirich, Polytechnic Institute of Brooklyn

11:00 A.M. Panel Discussion—"Water Thinned Paints for Industrial Use"

#### Concurrent Meetings

*In Auditorium Ball Room*

2:00 P.M. "Solvent Properties of Olefins From Petroleum"—W. W. Reynolds and H. Low. (A Room Award Competition Paper)  
 2:30 P.M. Panel Discussion—"Statistics as a Tool for Solving Paint Problems"  
 4:00 P.M. Installation of Federation Officers and Open Meeting

*In South Hall "C"*

2:00 P.M. Abstract of FATIPEC paper, "Les Résines Epoxy Desépoxydées" by Dr. Jean Poswick  
 2:10 P.M. "Wood Darkening"—Western Pine Association  
 2:30 P.M. Panel Discussion—"Cellulosic Finishes—New Formulating Approaches"

#### SOCIAL EVENTS

**Tuesday, October 7th, 7:00 P.M.**  
 Annual Banquet, Entertainment, and Dance

#### REGISTRATION

Sunday	October 5th	11:00 a.m. - 3:00 p.m.
Monday	October 6th	8:00 a.m. - 5:00 p.m.
Tuesday	October 7th	8:00 a.m. - 5:00 p.m.
Wednesday	October 8th	8:00 a.m. - 1:00 p.m.

*Cleveland, Carter, and  
 Statler Hotels  
 Public Auditorium only  
 Public Auditorium only  
 Public Auditorium only*



JOSEPH W. TOMECKO  
President

# Officers Federation of Paint and Varnish Production Clubs

•

*36th ANNUAL MEETING*



HOWARD G. SCHOLL  
President-Elect



RAYMOND C. ADAMS  
Treasurer



C. HOMER FLYNN  
Executive Secretary

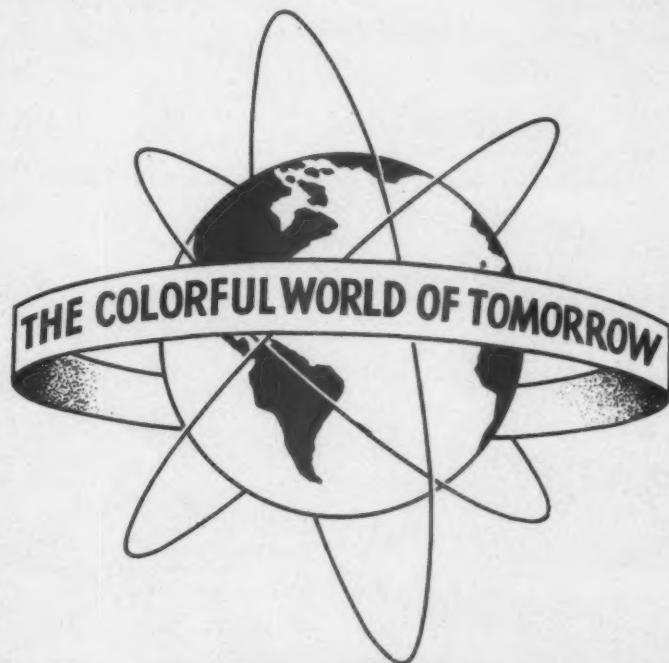
# Officers National Paint, Varnish and Lacquer Association

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*71st CONVENTION*



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H. BRAITH DAVIS  
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B. M. BELCHER  
Chairman, Executive Committee

# EXHIBITORS AT 1958 PAINT INDUSTRIES' SHOW

Main Arena, Public Auditorium

Cleveland, Ohio

October 6, 7, 8

## EXHIBIT HOURS

Monday, October 6th	12:00 noon - 6:00 p.m.
Tuesday, October 7th	9:00 a.m. - 5:00 p.m.
Wednesday, October 8th	9:00 a.m. - 4:00 p.m.

	Booth No.		Booth No.
<b>A</b>			
PAUL O. ABBE, INC. Little Falls, N.J. Ball and Pebble Mills, Mixers Garlick Ringen Kleinfeldt Philo Wright	114	ANDERSON-PRICHARD CORPORATION Oklahoma City, Okla. Solvents, Thinners, Diluents Dresser Gault Centracco Bettis Rooney Johnson Rubek Zimmermann	80
ADVANCE SOLVENTS & CHEMICAL Div. of Carlisle Chemical Works, Inc. New Brunswick, N.J. Water Dispersible Catalysts, Wetting Agents, Anti-Foam Agents Gregg Burger Tucker Frankel Baracani	34-35	ARCHER-DANIELS-MIDLAND COMPANY Minneapolis, Minn. Water Soluble Resins, Water Emulsion Resins, Synthetic Resins, Linseed Oil, Soybean Oils, Fatty Acids Representatives from all departments	96, 133
AIR REDUCTION CHEMICAL COMPANY A Div. of Air Reduction Co., Inc. New York, N.Y. Vinyl Monomers, Pigment Dispersants, Defoamers, Acetylenic Alcohols Tinnon Cole Herman Gilardi Lehr Duffy Law Schmalfuss Mrs. Schultz	23	ATLAS ELECTRIC DEVICES COMPANY Chicago, Ill. Weather-Ometer Alport Metzinger — See Advertisement Page 118 —	30
C. M. AMBROSE COMPANY Seattle, Wash. Filling, Closing, Coding and Counting Machines, Strainers Ambrose Styba — See Advertisement Page 101 —	73	BAKELITE COMPANY Division of Union Carbide Corporation Vinyl Dispersions, Vinyl Latex, Epoxy Troweling Compounds Lyon Ingram Fix Callas Swain Nelson Bertics Schwahn Norum Greenhood Larson Sharp Smith Foxdee Richardson McCullough McKnight Sullivan Behrens	36-38
AMOCO CHEMICALS CORPORATION Chicago, Ill. Phthalic Anhydride, Isophthalic Acid, Terephthalic Acid, Benzoic Acid, Hydrocarbon Resins and Resin Solutions, Aromatic Solvents, Polybutenes, Trimellitic Anhydride Hubbard Hoover Elliot Hager Perkins Bruggeman Cassis McKay Peterson Franks Amos Eiszner	129-130	— See Advertisements Pages 21, 22, 23, 24 —	
<b>B</b>		BAKER CASTOR OIL COMPANY Bayonne, N.J. Castor Polyols, Drying Oils, Plasticizers, Additives, Fatty Acids Orling Hayes Jubanowsky Bolly Patton Metz Swenson Ottens — See Advertisement Page 157 —	8

	Booth No.	Booth No.					
BENNETT INDUSTRIES, INC. Peotone, Ill. Steel Pails, Steel Drums, Fibre Drums, Closing Machine, Drum Printer	98-99	CHISHOLM RYDER of PENNA. Hanover, Pa. Labelling and Filling Machines	44-45				
Bennett Kuckie	LePan Kapaa	Abendschein Severson Williams	Anderson				
BORDEN CHEMICAL COMPANY New York, N.Y. Acrylic, Butadiene-Styrene and Polyvinyl Acetate Resin Emulsions, Thickeners	137-138	CIBA PRODUCTS CORP. Kimberton, Pa. Epoxy Resins	47-48				
Galbraith West	Gordon Young	Gruber Joseph Thompson	Busker Maslow Senseman	Dodds Nikles	Johnson Robinson		
— See Advertisement Page 13 —							
BUCKMAN LABORATORIES, INC. Memphis, Tenn. Preservatives, Fungicides	39-40	COLTON CHEMICAL COMPANY Cleveland, Ohio Paints Formulated with PVAc Emulsion	89-90				
Buckman Weiss	Stitt Ross	Hill Kaine Ostrow Campen	Meadows Werner Ames Newman	Stettler Dill Jaffe Coff	Smith Krashin Fickenscher Greenfield		
C							
GODFREY L. CABOT, INC. Boston, Mass. Cab-O-sil, Carbon Blacks, Wollastonite	42-43	COLUMBIAN CARBON CO. New York, N.Y. Carbon Black, Black Dispersions, Iron Oxides	65				
Berstein Magno	Bullock Parsons	Carpenter Zoeller	Clark	Koges Kocik Seles	Bryant Downs Foster	Stiff Bosworth Venuto	Tudder Pamer Katona
— See Advertisement Page 74 —							
CAMBRIDGE INDUSTRIES COMPANY Cambridge, Mass. Resinous Plasticizers, Gas Chromatography Liquids	14	COMMERCIAL SOLVENTS CORP. New York, N.Y. 2-Nitropropane for Vinyl, Acrylic, and Epoxy Coatings	91-92				
Pockel	Stone						Representatives from all departments
— See Advertisement Page 33 —							
CARBOLA CHEMICAL COMPANY, INC. Natural Bridge, N.Y. Extender Pigments for Latex Paints	63	CUNO ENGINEERING CORPORATION Meriden, Conn. Filters	56				
Brown Spriggs	Heikel	Koenig	Roast	Grupe Townen	McEnally	Munday	Palmer
D							
CARBON DISPERSIONS, INC. Newark, N.J. Carbon and Lampblack Dispersions, Color Dispersions	119	DANIEL PRODUCTS COMPANY Jersey City, N.J. Phthalo Blue Toner Dispersion, Silica Flatting Bases, Dispersible Lampblack Powder	66				
Brauch	Keegan			Daniel			
— See Advertisement Page 155 —							
CARGILL INC. Minneapolis, Minn. Linseed Oil, Soybean Oil, Fish Oil, Alkyd Resins, Poly- urethanes, Isophthalic Oils	3-4	J. H. DAY COMPANY Div. of Automatic Machine Co. Cincinnati, Ohio Mixing and Milling Equipment	127-128				
Simmonds Klobe Rogaliner	Stanton Kantor Spitz	Schembri Martin Donnelly	Knott Roholt	Diltz	Nolan	Allison	
— See Advertisement Page 155 —							
CATALYTIC COMBUSTION CORPORATION Detroit, Mich. Oxidizing Catalysts, Air Pollution Control Equipment, Heat and Energy Recovery Systems	142	DEWY and ALMY CHEMICAL DIV. W. R. Grace & Co. Cambridge, Mass. Vinyl Emulsions, Dispersing Agents, Specialty Polymers	68-69				
Ruff Hubert	Goodell	Van Hala	Donahue	Gibian Broughton Partrick Zirpolo	Brookes Kaalstad Jackson Rhode	Tompkins Sullivan Neuhofner Scheufele	Morton Larson Miner
— See Advertisement Page 155 —							
CELANESE CORPORATION OF AMERICA Chemical Div. New York, N.Y. Solvents, Flame-Retardant Plasticizers, Acrylates, Inter- mediates, Polyols	61-62	DOW CORNING CORPORATION Midland, Mich. Silicone Intermediates, Pure Silicone Resins, Silicone Masonry Water Repellents, Silicone Paint Additives	139				
Kampschulte Weich Mamola	Hecht Wyart Swaney	Werner Purcell	Schwab Hanna	Vidal Meath	McLean Thorsberg	Hedlund Delnevo	Tyler
— See Advertisement Page 32 —							
CELANESE CORPORATION OF AMERICA Plastics Div. Newark, N.J. Polyvinyl Acetate Emulsions, Homopolymer and Co- polymers	18-20	E. I. DUPONT DE NEMOURS & COMPANY Electrochemicals Dept. Wilmington, Del. Polyvinyl Acetate Emulsions	81-82				
Proudfoot Barker Miss Stevens	Bloom Kitchill Miss Raymond	Melvin Becker	Shea Malley	Sawyer Dustman	Seidel Badgley	Beardsley Byrum	
— See Advertisements Pages 91, 92, 93, 94 —							
CELOFILM INDUSTRIES, INC. Wood-Ridge, N.J. Nitrocellulose Solutions, Vinyl Solutions	97	E. I. DUPONT DE NEMOURS & CO., INC. Elastomer Chemicals Dept. Wilmington, Del. Synthetic Rubbers for Paint Vehicles, Paints Based on Synthetic Rubbers for Roofing Materials, Isocyanate for Urethane Vehicles	28-29				
Golden	Eymann	Bromley		Santora McSweeney	Kelly	Remington	Doherty
— See Advertisement Page 163 —							

Booth No.

Booth No.

E

**EASTMAN CHEMICAL PRODUCTS, INC.**

Subsidiary of Eastman Kodak Co.

Kingsport, Tenn.

Half-Second Butyrate, Sucrose Acetate Isobutyrate

Ball Miller Coney Crowley  
Lee Gearhart Ryburn Langston  
Abernathy Christiphine Cox Francisco  
Shelly Mahaffey Dubberly Trabue

— See Advertisements Pages 18, 133 —

57-58

**HARSHAW CHEMICAL COMPANY**

Cleveland, Ohio

Driers, Stearates, Yellow and Red Cadmium Lithopones,  
Organic Pigments, Color Dispersions

Close Coleman Connell Dickenson  
Foote Harris Hummel Molinari  
Stacey Straka Tucker Unkefer

— See Advertisement Page 139 —

146-147

F

**FARNOW, INC.**

Long Island City, N.Y.

Alkyds, Varnishes

B. Farber S. Farber Bauman Freund  
Saputo Shandler

— See Advertisement Page 120 —

105

**HEYDEN NEWPORT CHEMICAL CORP.**

New York, N.Y.

Pentaerythritol, Polyols

Barkley Boyer Doroskin Drubel  
Wolf

— See Advertisement Page 153 —

59-60

G

**GENERAL ANILINE and FILM CORP.**

New York, N.Y.

Pigments, Dispersions, Light Absorbers, Methyl and  
Vinyl Pyrrolidone for Pigment Grinding

Walsh Weth Gannon Tator  
Frazen Day Sanchirico Woodward  
Wich

— See Advertisement Page 102 —

33

**IMPERIAL PAPER & COLOR CORPORATION**

Glens Falls, N.Y.

Yellow and Red Pigments, Pigment Dispersions

Putnam Wakefield Donohue Sherman  
Nanovic Johannsson deRagonon Goble  
Bishop Mayo LaBelle Ray

— See Advertisement Page 121 —

112-113

**GENERAL MILLS**

Chemical Div.

Kankakee, Ill.

Polyamide Resins, Epoxy Curing Agents

Von Oehsen Murphy Kron Herban  
Terry Hull Christiansen Price  
de Meurisse Boyd Floyd Vincent  
Hanson

100-101

**INSTRUMENT DEVELOPMENT LABORATORIES, INC.**

Attleboro, Mass.

Color-Eye, Color Tolerance Computer

Johnson Hall

7

**GENERAL TIRE & RUBBER COMPANY**

Chemical Div.

Akron, Ohio

Butadiene-Styrene Latices, Acrylic Latices

Hackim Kreider Phillips Boruff  
Deckel Steinkerchner

— See Advertisement Page 27 —

110

**INTERCHEMICAL CORP.**

Color and Chemicals Div.

Bound Brook, N.J.

Pigment Dispersions

Representatives from all departments

— See Advertisement Page 154 —

76

**GOODYEAR TIRE & RUBBER COMPANY**

Akron, Ohio

Styrene-Butadiene Solution Resins, Styrene-Butadiene  
Latices

Thies Workman McNeer Wallace  
Nees Bear Hussey Kann  
Jenkins Dyer Warner Platner  
Tally Kelly Gerrow

70-72

**INTERNATIONAL TALC CO., INC.**

New York, N.Y.

Asbestine Line

Biggio McCarthy Paterson Smart

— See Advertisement Page 104 —

131

**GREAT LAKES CARBON CORPORATION**

Dicalite Department

Los Angeles, Calif.

Diatomaceous Silica, Kaolin Clay, Talc, Pyrophyllite

Halvorsen Huntley Kiefer Matthews

31-32

**JOHNS-MANVILLE SALES CORPORATION**

New York, N.Y.

Celite Diatomaceous Silica, Micro-Cel Hydrated Synthetic  
Calcium Silicate

Cipolla Martinson Kranich Amberg  
Weil Jones

— See Advertisement Page 31 —

111

H

**HAMILTON EQUIPMENT COMPANY**

Paterson, N.J.

Drum Handlers, Portable Mixers

Bristol Martin

10

**SPENCER KELLOGG & SONS**

Buffalo, N.Y.

Styreneated Oils, Vinyltoluene Copolymers, Polyurethanes

Healy Beyer Terrill Smith  
James Nagel Engel Weiffenbach  
Greer Turve Bristol Kellogg  
Beineman Farstad

— See Advertisement Page 122 —

106-107

47  
09  
60  
-2  
53  
3  
7  
6  
1  
47

**Booth No.**

**KENT MACHINE WORKS, INC.**

Brooklyn, N.Y.  
Roller Mill, High Speed Mixer  
Peters DeSena Latina  
— See Advertisement Page 149 —

26

**KINETIC DISPERSION CORPORATION**

Buffalo, N.Y.  
Mixing Machines  
Kew Wallace Behrns Callahan Wheeler Pluta

93-94

**H. KOHNSTAMM & COMPANY, INC.**

New York, N.Y.  
Pigment Colors  
Kohnstamm Johnson Agre Olson Torter Coplan

116

**L**

**LACQUER INFORMATION CENTER**

Latest Developments in Lacquer Technology, Formulation and Application  
Columbian Carbon Co. Enjay Co.  
Hercules Powder Co. Olin Mathieson Chemical Corp.  
Shell Chemical Corp. Sprayon Products, Inc.  
Standard Ultramarine & Color Co. Union Carbide Chemicals Co.

55 & 95

**J. M. LEHMANN COMPANY, INC.**

Lyndhurst, N.J.  
Roller Mills and Mixers, Paint Screens  
Muller Mierswa Dittman Grale

125

— See Advertisement Page 42 —

**M**

**MACBETH CORPORATION**

Newburgh, N.Y.  
Color Matching Lights, Vision Testing Equipment,  
Tinting Illuminator  
Meeker Merrifield

2

**METALS DISINTEGRATING COMPANY, INC.**

Elizabeth, N.J.  
Aluminum Pigments, Gold Bronze Powders  
Collins McKinley Sheaffer Town  
Knoll

15-16

**MINERAL PIGMENTS CORP.**

Muirkirk, Md.  
Dry and Pulp Colors, Iron Oxides, Inorganic Pigments  
Representatives from all departments

50

**MINERALS & CHEMICALS CORP. OF AMERICA**

Menlo Park, N.J.  
Aluminum Silicate Pigments, Attapulgite, Bauxite,  
Inert Fillers

143

Blake P. Wheeler Hempel Wilcox  
J. Wheeler Smith

102-103

**MONSANTO CHEMICAL CO.**

Plastics Div.  
Springfield, Mass.  
Lytron 680 Latex, Melamine and Urea Resins  
Watt Gray Jones Parker  
Gordon Werner Green Schmidt  
Goodacre Macpherson Cochran Francis  
Brown Hahn Traverso

17 & 54

**MOREHOUSE-COWLES, INC.**

Los Angeles, Calif.  
High Speed Mills, Dissolvers  
Morehouse Grubbs Meyer Smoot  
Purcell Missbach

115

**N**

**NAFTONE, INC.**

New York, N.Y.  
Liquid Driers, Naphthenate Driers, Tallates, Anti-Skinning Agents, Preservatives

115

Applegate Lilla McTavey Martin  
Smith

— See Advertisement Page 150 —

**Booth No.**

**NATIONAL ANILINE DIV.**

Allied Chemical Corp.  
New York, N.Y.  
Maleic Anhydride, Phthalic Anhydride, Fumaric Acid, Intermediates, Anti-Skinning Agents, Curing Agents, Solvents, Surface Active Agents, Diisocyanates

Morgan Seigle Bailey Johnson  
Weiss Reed Rhodes Vall  
Schmidt Holton Miller Mahoney  
Kirk Keane Perella Hoffman

— See Advertisement Page 25 —

83-84

**NATIONAL LEAD COMPANY**

New York, N.Y.  
Rust Inhibiting Pigments

Adams Anderson Bates Blackmore  
Diehlmam Eickhoff Howard Lominska  
Vettewinkel Whitney Zimmermann

21-22

**NATIONAL STARCH PRODUCTS, INC.**

New York, N.Y.  
Polyvinyl Acetate Polymer and Copolymer Emulsions

Dillon Thune Klempner Zahnrt  
Beggs Murphy Steed Stern  
Liberti Pierrhunbert Jubilee Kaplan  
Ciufa Burke Juenger Riley

64

**NEVILLE CHEMICAL COMPANY**

Pittsburgh, Pa.  
Cumarone-Indene, Petroleum Hydrocarbon Resins, Plasticizers, Coal-Tar and Petroleum Aromatic Solvents

Evans Clark Craig Villing  
Williams Isenberg

— See Advertisement Front Cover —

123-124

**NUODEX PRODUCTS COMPANY**

Div. of Heyden Newport Chemical Corp.  
Elizabeth, N.J.

Mixing and Milling Aids, Driers, Stearates, Anti-Skinning Agents, Vinyl Stabilizers, Bodying Agents, Paint Fungicides

Houston Dwyer Clark

74-75

**O**

**OLIN MATHIESON CHEMICAL CORP.**

New York, N.Y.  
Glycol Ethers, Ethyl Acetate, Surface Active Agents

Russell Malcom Aston Drummond  
Schrauf Hovey Hawkins

49

**ORONITE CHEMICAL COMPANY**

San Francisco, Calif.  
Phthalic Anhydride, Isophthalic Acid, Phenol

Billings Burkel Colaianni Gould  
Petersen Stephenson Van Buskirk

— See Advertisement Page 78 —

87

**P**

**PATTERSON FOUNDRY & MACHINE CO.**

East Liverpool, Ohio  
Ball and Pebble Mills, Jar Mills, Grinding Media, Synthetic Resin Plants

Witherow Jacobson Gant Custis Jebens  
Stephenson Dany

— See Advertisement Page 3 —

85-86

**PENNSYLVANIA INDUSTRIAL**

**CHEMICAL CORPORATION**

Claireton, Pa.  
Hydrocarbon Resins and Emulsions, Cumarone Indene Resins

Hollis Davis Shumar Kinny  
Brown Braun Stack Wilson  
Wolfe Young

— See Advertisement Page 143 —

132

**Q**

**THE Q-PANEL COMPANY**

Cleveland, Ohio  
Steel and Aluminum Panels, Treated Steel and Aluminum Panels

Grossman Antonik Chirdon

6

89

## R

**RAYBO CHEMICAL COMPANY**  
Huntington, W. Va.  
Paint Additives  
Hepner Conner

## Booth No.

24

**REICHHOLD CHEMICALS, INC.**

White Plains, N.Y.  
Hard Resins, Hard Resins in Solution, Liquid Resins, Esters

Knauss	Weismann	Drake	Pinkerman
Penniman	Rockenbach	Wilson	Fay
Baker	Hurst	Breedlove	Bloomquist
Lauren	Weinmann	Hose	Heimrich
Coerdt			

— See Advertisement 2nd Cover —

**ROHM AND HAAS COMPANY**

Philadelphia, Pa.  
Phenolic, Maleic, Alkyd, Polyester, Urea, Melamine and Acrylic Ester Resins

Technical representatives from all departments

— See Advertisement Page 80 —

**ROSS & ROWE, INC.**

New York, N.Y.  
Interface Modifier, Viscosity Modifier, Lecithin for Pigment Dispersion

Schlesinger	Hilti	McAuley	Kruse
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**CHARLES ROSS & SON COMPANY, INC.**

Brooklyn N.Y.  
Can Mixers, Roller Mills, Kneading Machines, Dis solvers, Dispersers, Paste and Pony Mixers

C. K. Ross	L. K. Ross	Tecky	Urks
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— See Advertisement Page 156 —

## S

**SHAWINIGAN RESINS CORPORATION**

Springfield, Mass.  
Polyvinyl Acetate Emulsions, Polyvinyl Formal

Bromley	Finsilver	Roth	Poole
Terry	Godsell	Hoyt	Kocher
Hill	Roland	Porter	Manning
Young	Ash		

— See Advertisement Page 135 —

**SHELL CHEMICAL CORPORATION**

New York, N.Y.  
Solvents, Glycerine, Epoxy Resins

Bayes	Buller	Butler	Curry
Howard	McGuigan	Moore	Neely
Norton	Somerville		

— See Advertisement Page 6 —

**SHELL OIL COMPANY**

New York, N.Y.  
Petroleum Solvents

Preu	Conn	Erickson	Waters
Ferrucci	Reynolds	Larson	Carnahan
Day	Dixon	Gilbert	Irwin
Kingsbury	McHenry	Niedermeier	Pugh
Sedlak	Silva		

— See Advertisement Page 40 —

**SILBERLINE MANUFACTURING COMPANY, INC.**

Stamford, Conn.  
Aluminum Pigments

Scheller	Smith	Usowski
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## T

**TROY CHEMICAL COMPANY**

Newark, N.J.  
Mildewcides, Driers, Bodying and Puffing Agents, Anti-Skinning Agents, Preservatives, Grinding Aids, Leveling Agents, Anti-Floating Agents, Fungicides, Anti-Settling Agents, Anti-Sagging Agents

Worthington	Goll	Singer	Sockloff
Rice			

— See Advertisement Page 144 —

**TROY ENGINE & MACHINE COMPANY**

Troy, Pa.  
Dispersion Equipment

Parsons	Brasington	Harrigan	Herrington
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— See Advertisement Back Cover —

## U

**UNION CARBIDE CHEMICALS COMPANY**

Div. of Union Carbide Corp.  
New York, N.Y.  
Chemicals for Lacquers and Latex Paints, Intermediates for Polyurethanes

Representatives from all departments

— See Advertisement Page 145 —

**U.S. STONEWARE COMPANY**

Akron, Ohio  
Grinding and Mixing Equipment

Farkas	Gomoll	Scales	Gross
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— See Advertisement Page 107 —

## V

**VELSICOL CHEMICAL CORPORATION**

Chicago, Ill.  
Solid, Liquid, Emulsified Hydrocarbon Resins and Polymers, Aromatic Solvents, Dicyclopentadiene

Burns	Conor	Drake	Lukas
Mayer	Schor		

— See Advertisement Page 15 —

**VULCAN STEEL CONTAINER CO.**

Birmingham, Ala.  
Pails and Drums

G. Zuck	R. Zuck	Kusta	Ryan
Little			

— See Advertisement Page 39 —

## W

**T. F. WASHBURN COMPANY**

Chicago, Ill.  
Thixotropic Paint Vehicles

C. Smith	Bennett	Fitzgerald	Frazier
Metz	Palmer	B. Smith	Eckley
Ellis	Klein		

**C. K. WILLIAMS & COMPANY**

E. St. Louis, Ill.  
Iron Oxide, Chromium Oxide Pigments Extenders

Alexander	Burris	Crumpier	Dubbdelman
Fuller	Green	Hathaway	Jeffrey
Kroopa	Gragor	Rambo	Nielson
Richards	Stewart	Stephens	Wells

— See Advertisement Page 138 —

**WITCO CHEMICAL COMPANY**

Phthalic Anhydride, Carbon Black, Surface Active Agents, Plasticizers, Driers, Emulsion Driers

Wishnick	Sucher	Gardner	Vaughn
Wendt	Barry	McKelvey	

— See Advertisement Page 82 —

EXHIBIT HOURS			
Monday, October 6th	12:00 noon - 6:00 p.m.		
Tuesday, October 7th	9:00 a.m. - 5:00 p.m.		
Wednesday, October 8th	9:00 a.m. - 4:00 p.m.		



A new Sales Service Laboratory near Wilmington, Delaware  
expands Du Pont technical facilities to provide . . .

NOW . . . the most  
comprehensive service  
program available  
to help you produce  
PVA paints . . .



Better Things for Better Living . . . through Chemistry

*Whether you now produce PVA paints or plan to...*

**Du Pont's new \$2 million  
Sales Service Laboratory provides**

**The research, products, and  
GROW with the expansion**

#### **RESEARCH**

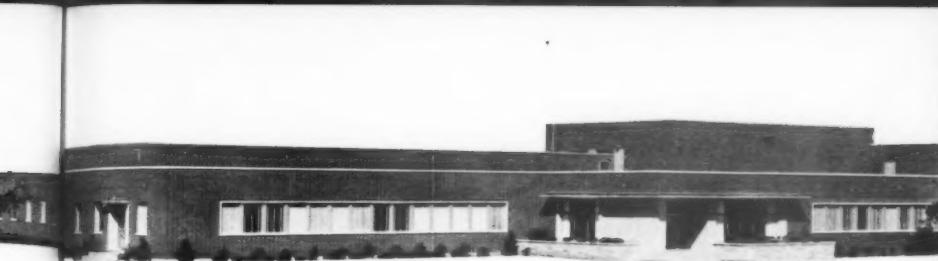


#### **ASSISTANCE**



**Trained specialists**, with extensive background in PVA paintistics, are constantly seeking ways to improve your formulation and production techniques. Your Du Pont Technical Ed. Representative will keep you informed of their findings to help you lower costs, improve paint quality, speed production.

**Your formulation problems** are a prime concern at the state-of-the-art lab. Specialists work with "Elvacet" scale equipment to parallel your operating conditions so they can come up with practical solutions. Du Pont Technical Products representatives are shown preparing paints in the lab to provide the added experience that enables them to give you on-the-spot service.



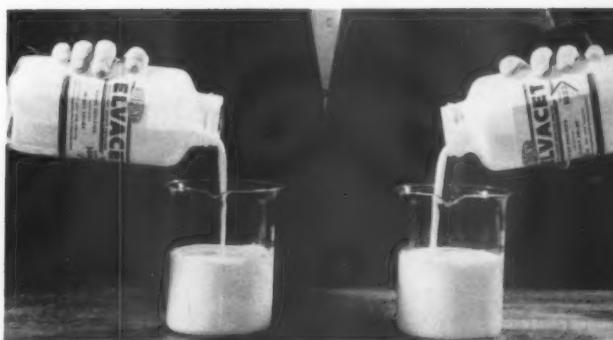
## ... and assistance to help you comarket for PVA paints

### DATA

with excheck performance characteristics, PVA paint formulations, prepared at the new Du Pont Technical Farm near Wilmington, Del. Over 7000 test panels have been exposed on "Elvacet" polyvinyl chloride emulsions have been exposed, in the past 10 years. Du Pont Technical Representative, shown reviewing these exposure panels, can arrange for you to visit the farm.



### PRODUCTS





Your key to this comprehensive service program on PVA paints is your Du Pont Technical Representative

Your Du Pont Technical Representative is your contact for all DuPont services on PVA paints—laboratory assistance, technical help, improved formulations. Du Pont has experienced technical representatives located in major paint manufacturing centers. Call today at the nearest Du Pont District Office listed below.

**DISTRICT AND SALES OFFICES:**

BALTIMORE • BOSTON • CHARLOTTE • CHICAGO • CINCINNATI • CLEVELAND • DETROIT • KANSAS CITY • LOS ANGELES • NEW YORK • PHILADELPHIA • SAN FRANCISCO • EXPORT DIVISION, WILMINGTON 98, DELAWARE.

\*Barada & Page, Inc., with Branch Offices in: Corpus Christi, Dallas, Fort Worth, Houston, and Odessa, Texas; New Orleans and Baton Rouge, La.; Tulsa and Oklahoma City, Okla.; and Wichita, Kan.

**E. I. DU PONT DE NEMOURS & CO. (INC.)**  
*Electrochemicals Department*  
**WILMINGTON 98, DELAWARE**

**ELVACET**  
polyvinyl acetate emulsion  
**FOR QUALITY PVA PAINTS**



**BETTER THINGS FOR BETTER LIVING**  
**... THROUGH CHEMISTRY**

# PRODUCTION

PACKAGING

MATERIAL  
HANDLING

NEW EQUIPMENT  
and MATERIALS



The Suggestion System can be a source of many ideas which both management and labor can benefit. For details on how to set up a suggestion system in your plant, see page 97.

# Continental gives you the MOST ADVANCED paint packaging protection!



## 6 to 9 months longer shelf life for PVA and latex base paints

Here's advanced paint packaging protection. Continental's exclusive Outward Curl can prevents corrosion because the raw metal edge of the friction ring is *outside* the can where paint can't touch it. PVA and latex base paints get 6 to 9 months longer shelf life! Available in quart and gallon sizes. A big sales-appealing feature for your paints.

## 50% greater protection against oxidation and skin formation

Tripletite can lids have three guard points instead of two. Your paints get 50% greater protection against oxidation. If air seeps through the first seal, the second or third is sure to stop it. Continental offers all standard sizes of paint cans from 4 ounce to 1 gallon, all with Tripletite protection. Call Continental for the most advanced paint packaging protection.

CONTINENTAL  CAN COMPANY

Eastern Division: 100 East 42nd Street, New York 17

Central Division: 135 South La Salle Street, Chicago 3

Pacific Division: Russ Building, San Francisco 4

Canadian Division: 5595 Park Street, Montreal, Que.

Call Continental for positive packaging  
protection...famous Continental service.

# THE SUGGESTION SYSTEM— A SOURCE FOR IDEAS

By  
Lawrence Shatkin

**A**FTER a company operating a suggestion system for the first time eliminates cigarette butts, wads of chewing gum, and petty gripes from its suggestion box, it will find a fountain of new ideas which can only lead to spiraling of profits and expansion of economy.

Awards for suggestions submitted annually run into the millions of dollars. Since the accrued savings to companies is some multiple of the awarded amount, it is strange that this particular area has been so badly neglected.

The greatest value of a suggestion system lies in developing people to think in the company and as an important asset in the development of good management-employee relations. It utilizes an untapped reservoir of thinking power, serves as a good management tool for the elimination of gripes, and is an excellent means of communication between top management and the worker.

#### Management's Role

In fact, the success of any suggestion system will depend solely upon the support of top management. The program must be built on a sincere belief in the value of employee participation. This cooperation is essential in order to motivate the individual to the point where it stimulates the flow of ideas.

The supervisor's or forman's role in any suggestion plan is no less

important than the position he occupies in his line-staff relationships. He is the man in the middle who can do much to ensure the success of the plan. He communicates both upward and downward, and can encourage or stifle the creativity of the worker. His actions, his fair dealings, his integrity, his leadership can instill the worker to forge ahead or retrench. The attitude of supervisory personnel can spell success or failure for a suggestion system.

The flow of ideas or inspirational

creativity is usually motivated by management measures. A receptive atmosphere is created by well-planned sales promotion techniques such as house organs, bulletin boards, brochures and other advertising media. Management must convey the feeling that every individual has the capacity for creative imagination in his own particular field of endeavor. The worker should be shown that his suggestions will put his company in a more competitive position ensuring greater earnings, growth, and job



Management discussing worker's plan for better plant house-keeping.

The opinions expressed in this column are strictly those of the author's and do not represent editorial endorsement by this publication.

security besides personal and immediate rewards.

To stimulate ideas of immediate importance, management should outline the areas where suggestions are needed. At all times the employee should be encouraged to discuss his suggestion with his superior, and proper recognition should be forthcoming. In the event a suggestion is not accepted, it is most important that the innovator be notified why his idea was not adopted and some verbal or other commendation bestowed. This course of action on the part of management must be done in a way that will encourage future efforts on the part of the employee.

When a cost reduction or work simplification program is initiated by management personnel, it can be made to coalesce into a suggestion program which stimulates workers to think about improvements. After all, suggestions that are adopted are nothing more than the application of common-sense thinking about how some job can be done better, faster or cheaper.

Firms who prefer to move gradually into this area can adopt a "Suggestion Day" or promote an "Idea Day." "What's Your Big Idea" was the question put forth by one large company. The results were beyond expectation, and some of the original suggestions are still in a stage of secret development because of the impact they will have on the market and the company's competitors. Where there is keen enthusiasm and an understanding policy in keeping within the spirit of one's plan, fairly good results are obtainable.

These good results demonstrate the fact that the rank-and-file employee is a prolific source of ideas for improved methods and reduced costs.

There are many ramifications regarding the structure and rules of a suggestion plan. However, the most pertinent fact to bear in mind is that simplicity in structure and operation is most effective. A few notes along these lines follows:

#### Policy and Organization

The object of any good system is to secure constructive suggestions from as many employees as possible and thus improve employer-employee relations.

A. In a formalized project or suggestion plan, *The Suggestion Committee* should be comprised of three top men qualified by reason of position and experience, representing various departments, and having final powers. They should be chosen by the President and serve for a one year period.

B. *Investigation* will ensue when the suggestion committee believes a submitted idea warrants such action by the line supervisor.

C. *Suggestion subjects* concern all parts of business:

1. Methods—simplify present methods, group or combine jobs, simplify your own job, devise new methods.
2. Machinery—simplify machines reduce machine set-up improve machine out-put, reduce maintenance cost
3. Work Conditions—improve safety and health, reduce fire hazard, reduce fatigue, make job less strenuous.
4. Material—eliminate scrap, find use for scrap or waste material, eliminate waiting time, speed delivery, suggest better, cheaper transportation.
5. Office Procedure—conserve supplies, reduce or simplify filing, eliminate duplication, combine forms, simplify office systems, improve procedure.
6. Merchandising—offer new promotional ideas, improve service, develop sales aid, improve store operations, reduce selling costs, improve dealer selling.

#### The Plan

A. *Receiving Suggestions*—Suggestion boxes are widely used and believed to be the most expedient. They should be attractive and well kept, and located in places where they are easily accessible.

B. *Suggestion Forms, Blanks and Records*—It is essential that record keeping be kept simple, and at a minimum. The records kept will play a relatively minor role in the success of a suggestion plan, but, if allowed to become too complex, could possibly disintegrate a hitherto good plan. The participa-

tion of management is of vital concern to the success of the plan.

C. *Identification of the Suggester*—These fall into four classifications:

1. Fully identified, 2. Partially identified, 3. Anonymous, 4. Signature optional,

D. *Eligibility*—Any worker paid by the hour is eligible; any salaried or office worker, not a member of the executive bonus plan is eligible. Salaried laboratory personnel and foreman would be eligible for an award if the suggestion is outside the scope of his department.

E. *The Analysis and Evaluation of Suggestions*—Everyone having to do with the analysis of an idea presented by an employee should take it for granted that every suggestion received has merit until the contrary is definitely proved. Even if eventually rejected, proper handling of the suggestion will improve communications and stimulate thinking by employees and supervisors.

F. *Awards*—Those of a tangible nature, where it is possible to calculate a definite savings, shall receive a percentage of the net savings, deducting the cost of putting the suggestion in operation from the gross figure. "The sky's the limit" should prevail, resulting in a "esprit de corps" on the part of the entire organization. Those of an intangible nature should be evaluated according to originality, impact on the company, and helpfulness.

G. *Non-adoption*—An employee should be personally notified why his suggestion was not used, and encouraged to submit other suggestions which are more specific.

H. *Promotion*—It is necessary to announce the plan, to explain it, and to gain the cooperation of the employees for whom it has been inaugurated. The Union should be consulted and informed about the plan.

In these days of rising costs and reduced profits, it is worthwhile to consider the employee as a fertile field for improved methods.

A systematic, successful, suggestion scheme will not only be measured in increased profits, but will improve the morale of the entire working force by welding and harmonizing management-worker relations.

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## Uniform Chemical and Physical Properties!

# HIGH QUALITY SOLTROL\* 130 ODORLESS MINERAL SPIRITS

● **CONTROLLED FOR QUALITY!** These water-white, odorless thinners are specially controlled, during the entire refining process, for quality and uniformity. They are specially handled, all along the line, to be sure they arrive at your plant in tiptop condition.

● **CONTROLLED EVAPORATION RATES!** When you need conventional drying characteristics, use Soltrol 130. For longer wet edge, use Soltrol 170. By varying the proportions of the two Soltrols you can obtain the special drying characteristics you require.

● **DEPENDABLE!** Phillips full-scale production facilities and fleet of tank cars rush your orders to you promptly. On time *every* time!

● **TEST SAMPLES!** Send for your free samples of Phillips 66 Soltrol today. See how these high quality odorless mineral spirits perform in *your* product.

\*A Trademark



**PHILLIPS PETROLEUM COMPANY • Special Products Division**

Bartlesville, Oklahoma  Bartlesville 6600

## New Development

### Kodak Test Determines Abrasion Resistance

A new method for determining the wet adherence of supported films to various bases has been worked out by Arthur S. Diamond of Kodak Research Laboratories, Rochester, N. Y.

The method provides a simple and precise means of measuring wet adherence or abrasion resistance of various coatings.

Mr. Diamond said that while the technique has so far been used only with emulsions applied to photographic film and paper, it could also be valuable in measuring a variety of coating materials and coated products such as paints, organic coatings, protective and decorative papers, plastics and textiles. It was developed in the paper service division at Kodak Park Works.

He explained that his method employs a pebble mill, charged with a specified amount of pebbles and fine quartz abrasive in water. A certain number of exposed film or paper samples are placed in the mill and abraded for several minutes, he said.

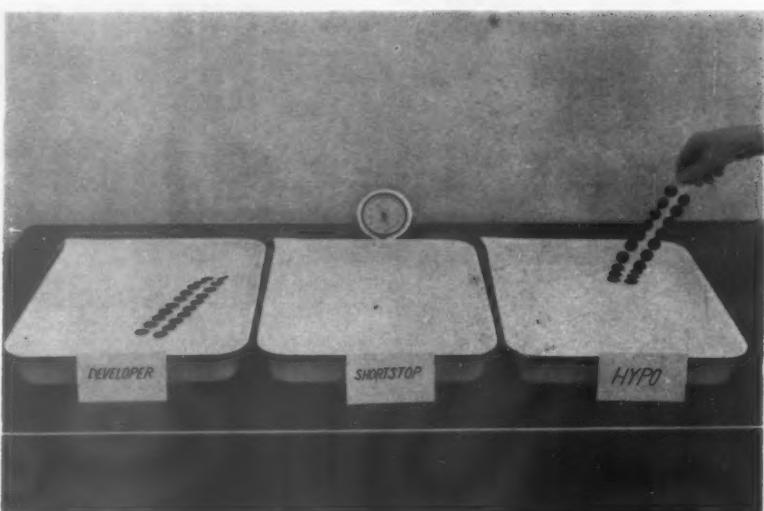
The samples are then placed in a optical densitometer to determine photometrically the per cent of emulsion area removed. This quantity is termed the "coefficient of abrasion," a measure of the wet abrasion resistance of the sample.

Mr. Diamond pointed out major advantages of the test. It provides a numerical rating based upon a physical measurement. Sensitivity can be varied readily by altering one or more of the mill conditions such as the milling time, liquid volume, or amount of abrasive charged.

It was noted that the test conditions can be easily standardized and operator variability virtually eliminated. Only a small sample is required, and the test can be performed quickly with readily available equipment.



Charging the pebble mill.



Processing of sample disks.



Measuring samples with the reflectance densitometer.

## New Series of Clays Offered By Georgia Kaolin

The Georgia Kaolin Company after three years of research has announced the availability of their Glomax series of calcined clays. These materials are finding particular applications in the paint industry. In order to assist the paint formulator in utilizing the desirable properties of calcined clays, the Georgia Kaolin Company has completed an extensive study on their effects in emulsion paint systems. The results of this study which required the making and testing of some 290 paints are summarized in a new brochure which has just been issued by the company.

Included in the study are the effects of calcined clays on the properties of acrylic, styrene butadiene, polyvinyl acetate, homopolymer, and copolymer paint systems. Data on such important properties as reflectance, gloss, contrast ratio, stain removal, enamel holdout, and color uniformity are given in this report. The calcined clay was used as the only extender pigment and in various combinations with regular clay extender pigments and titanium dioxide. The effect of different pigment volume concentrations and loading levels were also investigated. Based on the results of this study, suggested starting formulations are given for each of the major types of emulsion paint systems.

Further information can be obtained from the Georgia Kaolin representatives present at the Convention or write 433 North Broad Street, Elizabeth 3, New Jersey.

## New Carbonizing Formula Toughens Counter Tops

An improved formula for carbonizing laboratory counter tops for protection against chemicals has been developed by Hyde-Murphy Company, it has been announced. Tests indicated, the company said, that the wooden counter tops are non-reactive with acetic, formic, chromic or 20 per cent hydrochloric acids, ethyl or butyl alcohols, formaldehyde, acetone, ether, toluene, gasoline, mineral oil, hydrogen peroxide, or chlorine gas.

The new formula, developed by Hyde-Murphy's engineering staff in collaboration with Frank F. Marshall, Ridgway consulting chemist, includes six chemical coatings and a wash coat. When orders are placed sufficiently in advance, the company applies in addition a preliminary treatment designed to increase durability and quality.

Counter tops are available in either edge-grain birch or maple. All dimensions, including those of back-splashes, shelves, and pegboards, are available to specifications.

Construction is of narrow strips of wood glued together to counter warping tendencies. The bonds, which are of resin glue, are stronger

than the wood itself. Reinforcement is wood dowels spaced at two-foot intervals or, at customer's option, steel rods.

Separate tops are available, suitable for metal cabinets and counters, as well as for wooden units. Or entire laboratory desks may be supplied to order, with cabinets, shelves, drawers, pegboards, splashboards, and all other features built to specifications as to material, dimensions, and construction detail.

All millwork is delivered ready for use. Finished orders are stored in humidity-controlled rooms until delivery date. They are then delivered in Hyde-Murphy's own special vans.



The AMBROSE PF-5 is the newest combination five-gallon and one-gallon Filling and Sealing Machine on the market!

AIR POWERED  
FIRE HAZARD  
REDUCED  
TO A MINIMUM  
GEARLESS  
Few Metal-to-Metal parts  
REQUIRES ONLY 60 LBS.  
OF FREE AIR PRESSURE  
FOR ITS PUMP-TO-PAUL  
OPERATION

Combines economy with simplicity of construction. Fills and seals at speeds from 6 to 8 five-gallon pails per minute; fills and seals one-gallon pails at speeds from 14 to 16 containers per minute; depending upon viscosity of product, with accuracy to the drop!

This new machine is a time saver and a money saver. Its absolute accuracy in filling means savings in product overfilling. The PF-5 eliminates old fashion operations.

Delivers clean package. Fills ANY product that flows readily-light or heavy liquids.

No more outmoded sealing operations



**C. M. AMBROSE CO.**

The Pigment Department of GDC now offers dispersed organic pigments that have all the qualities needed for the new resin-emulsion paints—light fastness, resistance to alkali, and freedom from water-soluble electrolytes.

GDC dispersed pigments make possible a much wider

range of pleasing colors for both indoor and outdoor paints. They are available in either anionic or nonionic forms for ultimate compatibility and color value in the formulation used.

Write for complete information about these dispersed pigments—or call the GDC sales office nearest you.

## GDC DISPERSED PIGMENTS INCREASE THE COLOR RANGE FOR EMULSION PAINTS



ORDINARY PIGMENTS



GDC DISPERSED PIGMENTS

FROM RESEARCH TO REALITY



PIGMENT DEPARTMENT  
GENERAL DYESTUFF COMPANY

A SALES DIVISION OF

GENERAL ANILINE & FILM CORPORATION  
435 HUDSON STREET • NEW YORK 14, NEW YORK

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PROVIDENCE • SAN FRANCISCO • IN CANADA: CHEMICAL DEVELOPMENTS OF CANADA, LTD., MONTREAL

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# CLAPBOARD TEST PANEL PREPARATION

Du Pont pigments experts have found that, in testing outdoor performance of paints, valuable exposure time can be saved by following careful panel preparation procedures.

As a result, scientists at the Du Pont paint test farm and the new Pigments Department's Technical Service Laboratory at Chestnut Run near Wilmington have developed detailed procedures over the past 25 years which eliminate many of the variables in performance data. Critical factors include:

1. Types and differences of panels.
2. Application methods with resultant thickness of film.
3. Film drying conditions.

Selection of the wood is important. The standard surface used by the Chestnut Run laboratory is edge or vertical grain western red cedar clapboard, six-inches wide by three-feet long. Idaho white pine is used as an alternate when obtainable, with southern yellow pine sometimes used to provide a sever testing surface. Paints are also tested on

asbestos shingles cut to 8 by 12 inches.

Each panel is given a close personal inspection, and those with knots, gouges, cracks, or other defects discarded. This is important since blemishes under the paint being tested may be recorded later as film failures. The high percentage of panels discarded is considered essential as years of controlled exposure can be made worthless by a defective panel.

The back of the panels are sprayed with a good white exterior paint to seal out moisture during exposure on the fences. The Chestnut Run Laboratory uses "Ti Pure" FF/"Ti Pure" R-610/35% leaded ZnO/Mg Sil.-0.80/0.80/4.24/2.77 pounds per gallon in 4.25 pounds of 75/25 alkali refined /"X" bodied linseed oil and drier, thinned with mineral thinner to spray consistency. Faces of the panels are lightly sanded before applying the test paint.

Application of a consistently uniform film thickness is a critical problem. This has been solved by applying an exact volume of paint by a standard 20-cc medical syringe with the orifice enlarged.

Paint is applied by brush as in

DuPont's 25 years of experience finds that careful panel preparation can save valuable time in testing paint performance.

actual practice. Since differences in bristle length may have a considerable effect upon the coating applied, a set of six top quality brushes are used at a time and replaced as a unit.

Paint is distributed evenly over the entire surface by drawing from center to edges. Edges are painted with pat strokes followed by final leveling strokes on surface. Panels are then placed horizontally on a rack and rolled into a drying cabinet, which permits sufficient flow of air to prevent solvent entrapment. Two days are allowed between coats and seven days between the last coat and mounting on the fence.

Uniformity of film thickness is the most critical factor in panel preparation. At Chestnut Run, technician Mary Hutchison has been responsible for preparing panels for 15 years. In this time, she has painted more than 50,000 panels, including more than 90 per cent of the almost 30,000 panels on exposure at the Wilmington test farm. She also prepares panels for Du Pont test farm facilities at Hialeah, Fla., and El Monte, Calif.



Clapboard test panels are prepared at Du Pont's new pigments technical service laboratory by technician. Measured amount of paint is applied with standard 20-cc. medical syringe with orifice enlarged. Panels are hand sanded lightly prior to application.



Paint is brushed evenly over entire test panel by drawing paint from center to edges. Edges are done by pat strokes followed by final leveling strokes on surface. Care must be taken in final brushing not to remove paint from edges.



# NEW

## ASBESTINE 325

**64 YEARS** of production have paid off for International Talc Co. and its customers. As the world's largest producer of magnesium silicate, International Talc Co. announces the availability of their newest member to the family.... Asbestine - 325

### ★ THIS NEW PRODUCT FEATURES

Good dispersion with minimum use of oil needed in grinding. . . . enables formulating at higher pigment volume concentrations. Thereby. . . .

## REDUCING RAW MATERIAL COSTS

without affecting performance of storage characteristics.

Also available in other grades. . . . featuring these advantages

- 1. Available in low, medium and high oil absorption
- 2. Pure white — suitable for white or colored paints
- 3. Arcular structure affords good suspension
- 4. Mixes readily in all paint vehicles
- 5. Contributes to greater durability in exterior paints
- 6. Excellent flattening agent for flat or semigloss coatings
- 7. Uniformly low moisture content (less than .5% loss at 212°F.)
- 8. Bulking value 4.2 gallons per 100 lbs.
- 9. Packed in 50 lb. paper sacks for your convenience

### PRODUCT OF

## INTERNATIONAL TALC COMPANY, INC.

WORLD'S LARGEST PRODUCERS OF TALC

ESTABLISHED 1893

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INTERNATIONAL TALC CO., INC.  
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Please send FREE Sample and Technical Data  
on ASBESTINE 325.

Name.....  
Company.....  
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City..... State.....

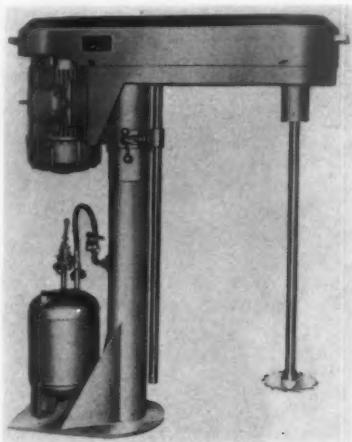
SEND COUPON FOR FREE SAMPLE  
AND TECHNICAL DATA ABOUT

## ASBESTINE 325

S. W. Tuttle, Vice-President

# NEW EQUIPMENT AND MATERIALS

This section is intended to keep our readers informed of new materials and equipment. While every effort is made to include only reputable products, their presence here does not constitute an official endorsement.



MOREHOUSE-COWLES

## COWLES DISSOLVER

Up To 15 H. P.

High speed dissolver for mixing batches of from 50 to 200 gallons. The unit, model 510-VH, requires only 7 sq. ft. of floor space, yet enables the application of 7½, 10, or 15 H.P.

Equipment has wide application in ultimate dispersion, dissolving, emulsifying, and deagglomerating in processing solid-liquid, liquid-liquid, or gas-liquid materials of up to 50,000 centipoises.

While in operation, the assembly can be raised by hydraulic lift. Minimum height is 69½", maximum 111½", a rise of 42". The impeller will center in a tank up to 48" in diameter.

Shaft speeds of 890, 1135, 1509, 1750, and 2040 r.p.m. can be quickly attained by use of interchangeable sheaves on the V-belt drive.

Bridge constructed to swing in a 180° arc and may be locked in any lateral position or height. Entire unit, without motor, weighs approximately 700 lbs.

Morehouse-Cowles, Inc., Dept. PVP, 1150 San Fernando Road, Los Angeles 65, California.

## PORTABLE MIXER

### New Design Clamp

New line of portable process mixers designed to meet highly critical operating conditions has been placed on the market.

These mixers feature a new design clamp using a worm-gear adjustment which eliminates possibility of tank damage or batch loss.

Units are also available for fixed mounting on either open or closed tanks.

Jensen Engineering Co., Dept. PVP, 5354 So. Garnett Road, P.O. Box 4507, Tulsa, Okla.



JENSEN

## ALUMINUM PASTE

### For Use With Alkyd Vehicles

Aluminum paste with improved performance for alkyd and other type synthetic resins.

Designated "Perma-Leaf" No. 7-311 paste, the product maintains leafing in many paint vehicles which normally cause deleaving within a few days.

Has been used successfully with some alkyds, alkyd melamines, urea formaldehydes, and vinyls.

The following characteristics are listed for the paste: NVM 70% minimum, screen retention 325 mesh 1.0% maximum, weight per gallon 12.12, and specific gravity 1.45.

Reynolds Metals Co., Dept. PVP, Richmond 18, Va.

## HAND CLEANER

### Deep Antiseptic

New Vibra-Clean waterless hand cleaner claimed to safely remove paint and varnish from exposed skin area.

Also said to deodorize. Easy to apply. Contains Actamer and lanolin.

Hanlon Chemical Co., Inc., Dept. PVP, 1016 S. Coy, Kansas City 5, Kansas.

## DRUM CRADLES

### With or Without Casters

Grizzly drum cradles for 55 and 30 gallon and smaller drums.

All welded, tubular frames and channel braces give cradles added strength. Designed for rugged use, all edges rounded and smooth.

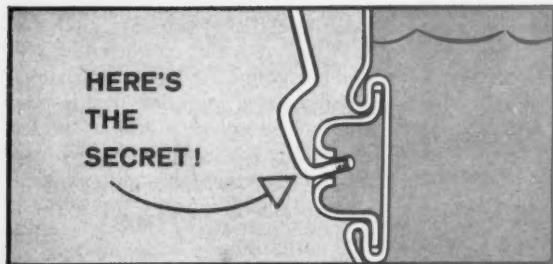
Available without and without casters, with and without drum rollers.

If requested, cradles are furnished with two swivel and two rigid

PUCEL



Have you tried Canco's new  
**Color Guard can**  
the only  
paint can  
guaranteed  
carry-safe!



An amazing new process, developed by Canco, clinches ears to the Color Guard can body without using a drop of solder. Result: the strongest handle ever and not a trace of sputtered flux to mar the can's appearance. A sure-selling container for your products!

Your supply of the Color Guard can will never be a problem for, even if a national emergency made tin and solder unavailable, it could still be manufactured with black plate.

*These cans are now being manufactured in Canco plants across the country . . . Jersey City, Philadelphia, Chicago, St. Louis, San Francisco, Los Angeles and Hamilton, Ontario.*

Have you tried them?

CANCO

American Can Company

**GRINDING COSTS GO DOWN**



**When you use**  
**ROALOX**  
**Burundum-Fortified**  
**GRINDING JARS**

**Here's why —**

**LONGER WEAR-LIFE**  
 Special wear-resistant porcelain is fortified with Burundum—our high density grinding media. You get more than twice the wear-life of conventional porcelain jars.

**GREATER STRENGTH**  
 Higher impact resistance reduces breakage hazards. Less chipping at lip and lid edges in handling.

**LESS CONTAMINATION**  
 Lower silica content and increased wear resistance means much less contamination of your product.

**SAVES TIME**  
 Extra wide mouth speeds loading and discharging. Lid and lid lock are one integral unit for quick, easy opening and closing.

**OTHER IMPORTANT ADVANTAGES**  
 Simple, positive locking. Rugged, heavy-duty hardware. Neoprene gaskets resist oil, chemicals, solvents. Optional draw-off lids.

**EIGHT SIZES:**  $\frac{1}{2}$  pint,  $\frac{1}{4}$ ,  $\frac{1}{2}$ ,  $1\frac{1}{2}$ ,  $2\frac{1}{2}$ ,  $3\frac{1}{2}$ ,  $4\frac{1}{2}$  and  $6\frac{1}{2}$  gallons. Steel or stainless steel jars also available in these sizes, unlined or lined with rubber.

**HANDY HINTS ON MILLING**

To get peak efficiency from your mills use "U. S." Burundum Grinding Media. Hard, tough, long-wearing, its high specific gravity and tubular shape give higher grinding efficiency with less milling time per batch.

For valuable milling data and complete description of "U. S." Grinding and Mixing Equipment, WRITE FOR BULLETIN 280.

107-F

PAINT AND VARNISH PRODUCTION, October 1958

PROCESS EQUIPMENT DIVISION



**U. S. STONEWARE**

AKRON 9, OHIO

107

**NEW  
MATERIALS -- EQUIPMENT**

casters to enable easy and quick placement to exact location for instant use. Rollers are for revolving drums for mixing, and draining alignment.

Cradles are 30 inches high, 18½ inches wide with various heights of 19, 25, 26½, and 27½ inches. Shipping weight is 30 to 40 pounds.

Pucel Enterprises, Inc., Dept. PVP, 3746 Kelley Avenue, Cleveland 14, Ohio.

**SILICONE ANTI FOAMS**

**Fast Dispersion**

Series of silicone antifoams now available.

Several advantages of this new

series are claimed. Silicone antifoams disperse immediately to provide quick foam knock-down; they are supplied as concentrates ready to use on delivery, or for quick, convenient dilution; they last longer, making them ideal for continuous processing; and they have a long storage life, can be frozen, boiled, or sterilized without losing effectiveness.

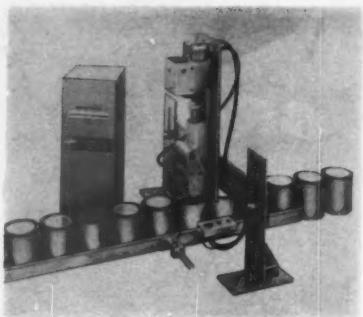
Hodag Chemical Corp., Dept. PVP, 7247 N. Central Park, Chicago 45, Ill.

**CAN CODER**

**Prints on Tops or Bottoms**

Bowers automatic can coder, designed in Canada, has been made available.

Claimed to print on either tops or



**J. M. LEHMANN**

bottoms of cans and that the special opaque quick-drying ink penetrates the palm oil in which cans are usually immersed, leaving a permanent code marking.

Said to print on containers in motion in any direction, without smearing. The action permits printing on cans of slightly different height without adjustment.

Coder fits on all types of can closing machines and has a capacity of sixty cans per minute. Handles containers from 1/32 to one gallon in capacity. Prints up to three lines of 12 characters each and is available for either pneumatic or electric operation in any voltage.

J.M. Lehmann Co., Inc., Dept. PVP, Lyndhurst, N.J.

**PHTHALOCYANINE PIGMENT  
Red-Shade; Crystal Stable**

A very red-shade phthalocyanine blue pigment that is crystal stable is available in Cyan Blue XR-55-3770.

Cyan Blue XR-55-3770 claimed to maintain its good initial bright hue and depth of color.

Said to develop a good red shade and display good dispersion and compatibility in solvent systems and in amine-modified alkyd baking enamels.

Product has the following properties: Specific gravity—1.52; Wt./gal., lbs.—12.7; Bulking value, gal./lb.—0.0787; Oil absorption—19.2.

Excellent resistance to bleed also claimed along with excellent light fastness and acid and alkali stability.

American Cyanamid Co., Pigments Division, Dept. PVP, 30 Rockefeller Plaza, New York 20, N.Y.

ONE OF THE MANY REASONS FOR DOING BUSINESS WITH NATIONAL CAN

NEW  
MATERIALS — EQUIPMENT



STRATTON

**BARREL HANDLER**

**Remote Control**

Barrel lifter-tipper-stacker has been made available.

Unit lifts drums or barrels to any desired height, then by remote control, the drum is tipped forward or backward or revolved in a complete 360 degree circle.

Unit quickly adjusted to fit any size drum or barrel and attaches instantly while the drum is in either a horizontal or vertical position.

Tipping action is sensitive and is said to be controlled extremely accurately.

Barrel handler unit can be easily removed from the Stratton Multi-Lift, which can then be converted to a forklift, platform, or crane.

The Stratton Equipment Co., Dept. PVP, 2030 East 105th St., Cleveland 6, Ohio.

**SODIUM SULFONATE**

**Oil-Soluble**

Lighter-colored sodium sulfonate now available.

New Sulfonate LC has a maximum ASTM (dilute) color specification of  $3\frac{1}{2}$  and is available in tankcar and tanktruck quantities.

Product is recommended for



**the PRJ-1G**

**McDANEL**

**LABORATORY MILL JAR**

**has recessed bronze hardware which  
prevents catching on roller-type  
laboratory mills.**

**S**mooth, long-wearing high-grade ceramic body. Easily and quickly cleaned inside and out. Close-fitting cover rests on soft rubber gasket. Cover can be tightened by hand. Neoprene gaskets available for oil base grinding. Actual capacity—5 qts. Over-all height— $11\frac{1}{8}$ ". Over-all diameter— $8\frac{1}{8}$ ". Ball charge included—7 lbs. of 1" and 3 lbs. of  $\frac{3}{4}$ " ceramic grinding balls.

**Write Today for McDanel Catalog B1-56 on Lab Jars,  
Grinding Balls, Mill Lining Brick and Mill Head  
Assemblies.**



**McDANEL**  
REFRACTORY PORCELAIN COMPANY  
BEAVER FALLS · PENNSYLVANIA

# On Latex Paints...



Top of mixer extends to 2nd floor, where it is charged. Note dust control hood.



Note thoroughly dispersed and blended latex paint in mix just before discharge.



Finished mix is discharged on first floor through valve in bottom of mixer. Photographs show Abbe Dispersall Mixer installation in plant of Pacific Paint & Varnish Co., Berkeley, Calif.

- Cut Mixing Time by One Half or Better
- Do The Entire Job in ONE Machine over the Complete Range of Your Color Card
- Get Complete Dispersion of ALL Ingredients, Regardless of Formulation
- Change Over from One Color to Another (Including White) in about Ten Minutes
- Get Maximum Color Values from a Minimum of Color
- Fill Directly from the Mixer or Pump to Storage

## The abbe' Dispersall Mixer

pays for itself in a year or less!

WRITE FOR CATALOG 78  
AND COMPLETE DATA

Address Department 64

**abbe'** ENGINEERING COMPANY  
420 Lexington Ave., New York 17, N. Y.

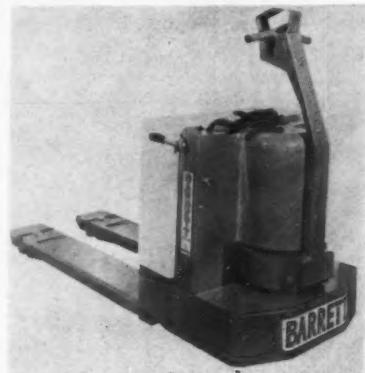
Designers and Manufacturers of  
Ball, Pebble and Jar Mills • Pulverizers • Sifters • Cutters • Mixers

N E W

## MATERIALS — EQUIPMENT

compounding, emulsifying, dispersing, and wetting agents; rust and corrosion inhibitors; demulsifying agents; dry cleaning compounds; fat-splitting agents; flotation agents; fuel oil, grease, and lubricating oil additives; metalworking oils; textile oils; and pigment dispersing agents.

Sun Oil Co., Dept. PVP, 1608 Walnut St., Philadelphia 3, Pa.



BARRETT

### ELECTRIC PALLET TRUCK

Operates in Narrow Aisles

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Compact drive mechanism with motor and transmission placed directly above the drive wheel reduces overall length and allows truck to operate in six foot aisles with 48x48 inch pallet loads. Load stop to extreme front end measures only 24½ inches.

Power lifting and lowering by pushbuttons located on rear of handle gives positive control over retraction and extension of the rear wheels.

Hydraulic unit has motor, pump, overload relief valve, and reservoir in a single package unit.

"Flying saucer" pallet entry discs on fork ends give the effect of three added inches of roller diameter to help skim forks into pallet with ease.

A thumb-touch butterfly type control on the handle gives two speeds forward and reverse. Total lift is four inches.

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One of these new products is derived from p-xylene, while the other two are m-xylene derivatives.

The new products are terephthaloyl chloride, a derivative of  $\gamma$ ,  $\gamma'$ -hexachloro-p-xylene,  $\gamma$ ,  $\gamma'$ -hexachloro-m-xylene, and its derivative isophthaloyl chloride.

All three of these chemicals represent interesting possibilities as intermediates for a variety of end-products.  $\gamma$ ,  $\gamma'$ -hexachloro-m-xylene hydrolyzes to isophthalic acid, forms isophthalic esters through alcoholysis, and can be halogenated in the ring.

Both terephthaloyl chloride and isophthaloyl chloride can be reduced to dialdehydes and dibasic acids, can be oxidized to acids, and can be

esterified easily with alcohols. They react readily with ammonia, amines, and amino compounds. These acid chlorides will undergo the Friedel-Crafts reaction, will react with organic sodium compounds, with Grignard reagents, and can be chlorinated.

The high reactivity of the terephthaloyl and isophthaloyl chlorides makes them especially interesting as raw materials for interfacial polycondensation for preparation of polyamides and polyphenylesters.

Diamond Alkali Co., Product Development Department, Dept. PVP, Research Center, Painesville, Ohio.

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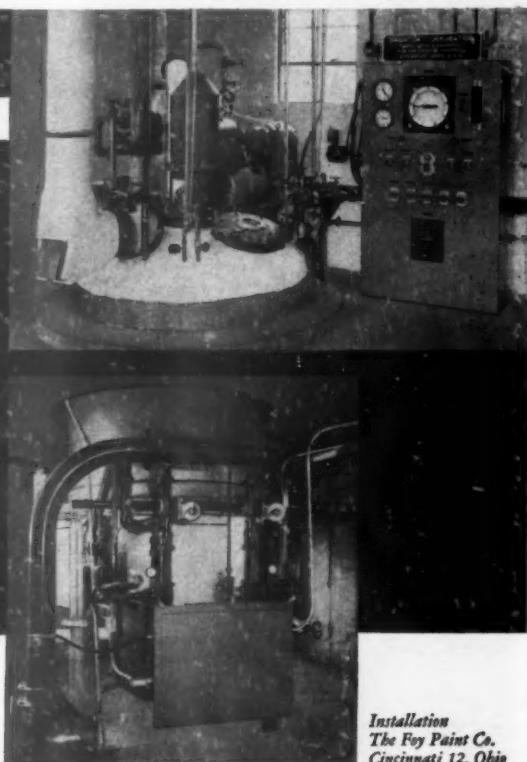
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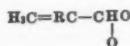
# PATENTS

Complete copies of any patents or trade-mark registration reported below may be obtained by sending 50c for each copy desired (to foreign countries \$1.00 per copy) to the publisher.

## Dispersion Polymerization of Formaldehyde

*U.S. Patent 2,844,561. Max Fredrick Bechtold, Kennett Square, Pa., and Robert Neal MacDonald, Wilmington, Del., assignors to E.I. duPont de Nemours & Co., Wilmington, Del., a corporation of Delaware.*

A normally solid, synthetic, film-forming composition resulting from the polymerization of formaldehyde in a liquid hydrocarbon medium containing a dissolved organic polymeric substance selected from the group consisting of (a) homopolymers of tertiary-amino-substituted olefins, (b) homopolymers of esters of N-dihydrocarbon-substituted aminoalcohols with an acid having the formula:



wherein R is selected from the group consisting of hydrogen, alkyl, aralkyl, and cycloalkyl, (c) copolymers of the said tertiary-amino-substituted olefins and an ester of an alcohol containing 6-18 carbon atoms and the above-described acid, and (d) copolymers of said esters of N-dihydrocarbon-substituted aminoalcohols and an ester of an alcohol containing 6-18 carbon atoms and the above described acid, said organic polymeric substance having an inherent viscosity of at least 0.1 measured at 25° C. on a 0.1% weight:volume concentration in benzene; said composition comprising a high molecular weight polymer of formaldehyde chemically combined with 0.001%-20% by weight of said organic polymeric substance, said composition being characterized by exhibiting an inherent viscosity of at least 1.0 measured at 60° C. on a 0.5 weight percent solution of said composition in p-chlorophenol containing 2% by weight of alpha-pinene, said composition being further characterized by having a degree of toughness of at least 1.0.

## Ready-Mixed Aluminum Coating

*U. S. Patent 2,843,554. Clyde G. Murphy, Springfield, Pa., assignor to E.I. du Pont de Nemours & Co., Wilmington, Del., a corporation of Delaware.*

A ready-mixed aluminized liquid coating composition characterized by package stability during lengthy storage and retention of leafing value during said storage, comprising an oleoresinous esterified polyether resin, fine particle size leafing-type aluminum pigment in the proportion of 30 to 100 parts for each 100 parts of said esterified polyether resin, and a volatile hydrocarbon solvent for said esterified polyether resin, said aluminum pigment having a fineness corresponding to at least 99.9% passage through a 325 mesh screen and at least 98% passage through a 400 mesh screen and further characterized by an average leafing value of at least 65% measured with a 1.5 gram sample of pigment paste having a non-volatile content of 65% and at least 60% when measured with a 1 gram sample of dry aluminum powder, said

oleoresinous esterified polyether resin comprising the esterification product of a mixture of higher fatty acids containing a preponderance of polyethenoid higher fatty acids, rosin acids and an esterifiable polyether resin, said polyether resin comprising the condensation product of a chlorohydrin reacted with a bis (4 hydroxyphenyl) alkane, said chlorohydrin being a member of the group consisting of epichlorohydrin and glyceroldichlorohydrin.

## Polyhalocarbon Coating Composition

*U.S. Patent 2,844,557. Pierre R. Welch, Washington, D. C.*

A coating composition comprising a uniform non-aqueous-liquid dispersion of particles of a normally solid fusible polyhalocarbon resin of about 0.1 to about three micron size, the halocarbon

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monomer from which said resin is formed being a halogen substituted low molecular weight hydrocarbon selected from the group consisting of unsaturated aliphatic and unsaturated alicyclic hydrocarbons in which the hydrogen atoms are entirely substituted by halogen other than fluorine, said monomer having an ethylenic bond in the molecule, and a film forming synthetic extender resin other than a polyhalocarbon resin, said extender resin when applied to a substrate and upon being heated to the temperature and for the time necessary to fuse the polyhalocarbon resin, having good spreading and flowout characteristics, forms a uniform coherent film tenaciously adhering to the substrate without decomposing or volatilizing, the dispersed polyhalocarbon resin particles being homogeneously distributed throughout said film, the dispersing medium being a volatile organic liquid solvent for the extender resin and being present in an amount to

form a compatible liquid dispersion of said resin, the polyhalocarbon resin comprising about 5% to about 70% by weight and the extender resin comprising about 95% to about 30% by weight of the total of said resin components in said composition.

#### Epoxy Resin, Polyvinyl Chloride, and Plasticizer

*U. S. Patent 2,843,557. Moyer M. Safford, Schenectady, N. Y., assignor to General Electric Co., a corporation of New York.*

A composition of matter consisting of an admixture of (1) 10-40% of a plasticizer, (2) 5-20% of a mixture of a glycidyl polyether of a dihydric phenol and a polyamide having at least two active amido hydrogens per molecule and wherein the amide group is attached directly to another carbon atom, and (3) 50-70% of polyvinyl chloride, the sum of (1), (2), and (3) being equal to 100%.



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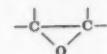
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#### Cellulose Nitrate-Liquid Polymer Oil Compositions

*U.S. Patent 2,842,452. Donald F. Koencke, Westfield, and Harold J. Brady, Bayonne, N. J., assignors to Esso Research and Engineering Co., a corporation of Delaware.*

A coating composition comprising a mixture of 1 to 100 parts of cellulose nitrate and 100 parts of polymer selected from the group consisting of homopolymers of butadiene and copolymers of butadiene with up to 50% styrene, said polymer having a substantial proportion of its double bonds converted, to the epoxide group



so that the final polymer contains 1 to 9.5% epoxide groups, said composition yielding films 1.5 to 3.5 mils thick which are hard and flexible after curing 10 to 60 minutes at 275° to 375° F.

#### Heat-Resistant Enameling Paint

*U.S. Patent 2,843,559. Murray Kornbluth, New York, N.Y., assignor to the U. S. A. as represented by the Secretary of the Army.*

A high-temperature resistant enameling paint for producing a vitreous enamel anti-corrosion coating on ferrous metal shapes at elevated temperatures, which comprises a vehicle consisting essentially of a silicone polymer varnish for providing a high heat-resisting binder film, and a refractory frit as a pigment base for the paint, the said frit being an aggregate of a plurality of frits having stepwise increasing melting points between approximately 1050° F. and approximately 1600° F. to provide when fused a vitreous enamel coating for the ferrous shape to be protected.

#### Aqueous Vehicles For Forming Water-Resistant Films

*U.S. Patent 2,842,451. Oliver J. Grummitt and Albert A. Arters, Cleveland, Ohio, assignors to The Sherwin-Williams Company, Cleveland, Ohio, a corporation of Ohio.*

The method of making a stable homogeneous aqueous composition of a water-dispersible, film-forming material which comprises the steps of dispersing a free acid form of carboxymethyl cellulose in water, adding to said water dispersion of carboxymethyl cellulose acids a water-soluble zirconium salt with vigorous agitation, and in an amount sufficient to yield a ratio of zirconium to carboxyl in the range of from 0.15 to 2, continuing the agitation until the mixture is homogeneous, adding ammonium carbonate with agitation, continuing the agitation until all froth-

ing and gelling has disappeared and the composition has become liquid, and adjusting the pH of the resultant composition to more than 7.5 and less than 9.

#### Room Temperature Curing

##### Organic-Polysiloxane

*U.S. Patent 2,843,555. Charles A. Berridge, Cohoes, N. Y., assignor to General Electric Co., a corporation of New York.*

The cured composition obtained from a mixture of ingredients comprising (1) a linear, fluid organopolysiloxane containing terminal silicon-bonded hydroxy groups convertible to the cured, solid, elastic state and having a viscosity of from 1,000 to 50,000 centipoises when measured at 25° C., the organic groups of the aforesaid organopolysiloxane being selected from the class consisting of monovalent hydrocarbon radicals and halogenated aryl radicals attached to silicon by carbon-silicon linkages, (2) an alkyl silicate selected from the class consisting of (a) monomeric organosilicates corresponding to the general formula



where R and R' are members selected from the class consisting of alkyl groups and halogen-substituted alkyl groups, and R', in addition, represents a member selected from the class consisting of aryl, aralkyl, alkaryl, alkoxy, aryloxy groups, and halogenated derivatives of the afore said aryl, aralkyl, alkaryl, alkoxy and aryloxy groups and (b) liquid partial hydrolysis products of the afore mentioned organosilicate monomeric compounds, and (3) a metallic salt of an organic monocarboxylic acid in which the metal ion is selected from the class consisting of lead, tin, zirconium, antimony, iron, cadmium, barium, calcium, titanium, bismuth and manganese.

#### Primers For Vinyl

##### Resin Coating

*U.S. Patent 2,842,459. Frank Gollub and Marvin S. Wool, Univ. City, and William D. Berberich, St. Louis, Mo., assignors to Dennis Chem. Co., St. Louis, Mo., a corporation of Missouri.*

The method of bonding a vinyl resin coating to a surface which comprises applying a primer to said surface, said primer comprising a mixture of a methyl methacrylate polymer and an unesterified epoxy resin dissolved in an organic solvent, the ratio of said methacrylate polymer to said epoxy resin being between approximately 15:85 and 99:1, volatilizing said solvent, applying a vinyl resin dispersion to the primed surface, and thereafter heating the dispersion.

#### Corrosion Resistant Coatings

*U. S. Patent 2,843,503. Martin Sale and Gerard J. Clarke, Rochester, N. Y., assignors to Eastman Kodak Company, Rochester, N. Y., a corporation of New Jersey.*

A process for providing a corrosion-resistant coating for steel in which at least three successive coatings are applied comprising coating with a primer comprising about 9% cellulose acetate butyrate, 8.6% zinc tetroxy-chromate, and a solvent mixture consisting of toluene, methyl Cellosolve and ethyl alcohol, applying a second coating comprising 60-95% cellulose

acetate butyrate, 5-40% methylol phenyl allyl ether, about 0.3% phosphoric acid, solids basis, and a solvent mixture consisting of xylene, toluene, butyl alcohol, isopropyl alcohol and butyl acetate, and a third coating comprising 9.1% cellulose acetate butyrate and a solvent mixture consisting of xylene, toluene, butyl alcohol, isopropyl alcohol and butyl acetate.

#### Water Dispersible Talc Pigment

*U. S. Patent 2,844,486. Richard S. Lamar, La Canada, Calif., assignor to Sierra Talc & Clay Co., South Pasadena, Calif., a corporation of California.*



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A strong hydrophilic talc pigment comprising finely comminuted talc particles having their surfaces at least partly coated with a nonionic surfactant having a hydrophobic portion chemically bound to a hydrophilic portion consisting of polyethylene oxide groups.

#### Alkenylphenol-Aldehyde

U. S. Patent 2,843,566. Roger M. Christenson, Whitefish Bay, and Lowell O. Cummings and Alfred R. Bader, Milwaukee, Wis., assignors to Pittsburgh Plate Glass Company.

A light colored resinous material comprising the product of the alkaline condensation of an aldehyde containing only atoms of carbon, hydrogen, and oxygen, with a mixture of butenylphenols containing about 55 percent to 85 percent by weight of ortho- and para-monobutylphenols, and about

15 percent to 45 percent by weight of di- and tri-butylphenols.

#### Acrylic Coating

U. S. Patent 2,849,409. John L. Evans, Springfield, Pa., assignor to E. I. du Pont de Nemours and Company, Wilmington, Del., a corporation of Delaware.

A liquid coating composition comprising as an essential film-forming constituent a polymer of methyl methacrylate having a relative viscosity of about 1.117 to 1.196, cellulose acetate butyrate having a viscosity of about 0.1 to 2.0 seconds, and a solvent for said polymer and cellulose acetate butyrate, the weight ratio of cellulose acetate butyrate to polymer of methyl methacrylate being between 15:85 and 75:25, and said polymer of methyl meth-

acrylate being a member of the group consisting of homopolymers of methyl methacrylate and copolymers of methyl methacrylate with from 2 to 25% by weight of a member of the group consisting of acrylic acid, methacrylic acid, a 1 to 4 carbon alkyl ester of acrylic acid, a 2 to 4 carbon alkyl ester of methacrylic acid, vinyl acetate, acrylonitrile, and styrene.

#### Wax Compositions

U. S. Patent 2,846,330. Erich Berthold, Hans Hoyer, and Guido von Rosenberg, Gersthofen, Germany, assignors to Farwerke Hoechst Aktiengesellschaft vormals Meister Lucius & Bruning, Frankfurt am Main, Germany, a corporation of Germany.

A wax composition comprising a homogeneous mixture which contains (a) a high content of ester reaction products of at least one polyhydric alcohol and a mixture of montanic acid and at least one fatty acid having from 12 to 22 carbon atoms and (b) small proportions of calcium salts of said acids and the salts of at least one of said acids in which the cation is selected from the group consisting of zinc, magnesium, aluminum and mixtures thereof, the total metal content, calculated as free metal, not exceeding 5% based on the weight of the ester reaction products, the ester producing mixture of montanic acid and fatty acids being in the ratio of from 75 to 97 parts by weight of montanic acid to 25 to 3 parts by weight of fatty acid.

#### Butenyl Phenol-Aldehyde Resins

U. S. Patent 2,843,565. Roger M. Christenson, Whitefish Bay, and Lowell O. Cummings and Alfred R. Bader, Milwaukee, Wis., assignors to Pittsburgh Plate Glass Company.

A light colored resinous material comprising the product of the acidic condensation of an aldehyde containing only atoms of carbon, hydrogen, and oxygen, with a mixture of butenylphenols containing about 55 percent to 85 percent by weight of ortho- and para-monobutylphenols, and 15 percent to 45 percent by weight of di- and tri-butylphenols.

#### Metallic Pigment Formulations

U. S. Patent 2,848,344. Melvin H. Brown, Allegheny Township, Westmoreland County, Pa., assignor to Aluminum Co. of America, Pittsburgh, Pa., a corporation of Pennsylvania.

Metallic aluminum pigment formulations characterized by substantial absence of development of pressure in sealed containers of the same, said formulations consisting essentially of from 7 to 80 per cent aluminum flakes, from 0.1 to 4 percent of at least one fatty



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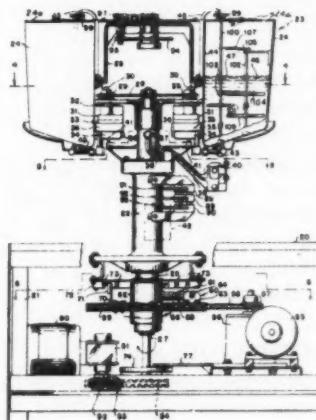
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acid lubricating agent selected from the group consisting of stearic, palmitic, oleic, ricinoleic and lauric acids, the total amount of said acids not exceeding 4 percent from 1 to 75 percent volatile hydrocarbon from 0.25 to 51 percent of at least one inhibitor selected from the group of nitro derivatives of aliphatic and aromatic hydrocarbons consisting of nitroethane, 1-nitropropane, 1-nitrobutane, 2-nitrobutane, nitrobenzene, o-nitrotoluene and 3-nitro-1,2-dimethyl benzene, the total amount of said nitro derivatives of aliphatic and aromatic hydrocarbons not exceeding 51 percent, and water in amounts of 0.1 to 1.5 percent by weight of the formulations.

#### Paint Mixing Machine

U. S. Patent 2,848,019. Milford H. Corbin and Robert L. Lippe, New York, Joseph T. Yater, Staten Island, Thomas E. Goodwin, Baldwin, John P. Drinjak, Uniondale, and Edmund M. Squire, New York, N. Y., assignors, by mesne assignments, to Color Carousel Corp., Staten Island, N. Y., a corporation of California.



U. S. Patent No. 2,848,019

Liquid dispensing apparatus of the class described, comprising: a plurality of liquid reservoirs; an electric motor; motor driven means operated by said motor for producing relative movement of said reservoirs and a container to be filled therefrom; braking means for abruptly stopping said motor; a plurality of separate selective means connected to said braking means for stopping said motor when a particular reservoir independently selected in each of said selective means is positioned in dispensing relationship with respect to said container; transfer means interposed between said selective means and said braking means for successively rendering each of said selective means individually effective; a stepping switch common to said plurality of selective means; controllable means for dispensing liquid from said particular

reservoir; means for advancing said stepping switch during dispensing operation of said controllable means; and an individual volumetric control means connected to each selective means to be effective therewith for operating said transfer means when said stepping switch has advanced to a position independently determinable by each of said volumetric control means.

#### Grinding Charge

#### For Ball Mills

U. S. Patent 2,847,169. William Walter Hartman, Los Angeles, Calif.

For use in a ball mill, a new and improved grinding element the shape of which conforms approximately with the interstice within a group of four balls symmetrically stacked so that the centers of each three of said four balls lie approximately at the vertices of four substantially identical equilateral triangles formed by straight lines joining

the centers of each three of said four stacked balls, and the surface of said grinding element having four concave grinding depressions registering approximately with the adjacent portion of the convex surfaces of said four symmetrically stacked balls.

ROMMEL, ALLWINE &

ROMMEL

REGISTERED PATENT

ATTORNEYS

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Patent Practice before U. S. Patent Office. Validity and Infringements Investigations and Opinions.

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**Diamond Chemicals**

# TECHNICAL

Bulletins

## SINGLE-PAN BALANCES

All of the single-pan balances in the Mettler line of Gram-atic balances are described and illustrated in a bulletin made available by the Fisher Scientific Co., Dept. PVP, 384 Fisher Bldg., Pittsburgh 19, Pa.

The gamut runs from a micro analytical balance with an accuracy of 0.002 milligram to a giant heavy-duty balance for remote-

control weighings in atomic plants.

Performance, design, and ordering data are included with each type of balance. Charts, illustrations, and diagrams are also contained in this 12-page brochure.

per solvent selection. Petroleum solvents are classified into aliphatic naphthas, paraffinic hydrocarbons, odorless solvents, aromatic hydrocarbons, and intermediate hydrocarbon solvents.

Amsco's line of petroleum solvents are presented in chart form with specifications showing the relative time of evaporation.

Another chart lists the individual solvents and their principal industrial uses.

## ROTARY TRUCK PUMPS

Revised Bulletin 200 has been released by the Blackmer Pump Co., Dept. PVP, Grand Rapids 9, Mich.

The bulletin provides up-to-date information on the firm's newly expanded line of rotary truck pumps.

The eight-page booklet describes the complete range of pumps with capacities from 25 to 725 GPM operating at discharge pressures to 100 psi.

The bulletin is well illustrated with cutaway photographs and exploded part drawings of the basic pumps.

In addition to application and selection data, there is also furnished dimension tables for all pump models along with specifications on the materials of construction that are available.

## DIATOMACEOUS SILICAS

Three grades of non-flux-calcined diatomaceous silicas, AG, Top, and Super grades, are described in TB #758-1 made available by Sole Chemical Corp., Dept. PVP, 27 E. Monroe St., Chicago 3, Ill.

Benefits, general information, and recommended uses are outlined in this bulletin.

## GEAR-HEAD PUMP

A bulletin released by the Blackmer Pump Co., Dept. PVP, Grand Rapids 9, Mich. describes a new line of gear-head rotary pumps with a helical gear reducer.

Designated Bulletin 110, the pumps are described in detail with cutaway photographs and exploded part drawings.

Complete application and selection data is furnished as well as performance curves and dimension tables.

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WRITE FOR SAMPLES AND INFORMATION

## ETHYLENE GLYCOLS

A 40-page bulletin on mono-, di-, tri-, and tetra-ethylene glycol has been published by Jefferson Chemical Co., Inc., Dept. PVP, 1121 Walker Ave., Houston 2, Tex.

The booklet presents a comprehensive review of the physical and chemical properties, and industrial uses of, ethylene glycol, diethylene glycol, triethylene glycol, and tetraethylene glycol.

Information is also provided on methods of shipment, specifications, and analytical techniques required for determining product quality.

Also included is an extensive indexed bibliography.

## NAPHTHENIC ACIDS

A bulletin on the firm's three grades of Sunaptic acids has been made available by the Sun Oil Co., Industrial Products Dept., Dept. PVP, 1608 Walnut St., Philadelphia 3, Pa.

The bulletin gives information on properties, specifications, applications, and shipping of the acids.

## POLYGLYCOLS

A revised edition of "Choosing the Right Polyglycol" has been made available by the Dow Chemical Co., Technical Service & Development, Dept. PVP, Midland, Mich.

Among the polyols described in this 24-page booklet are polyethylene glycols, polypropylene glycols, polybutylene glycols, polyepichlorohydrins, polystyrene glycols and miscellaneous polyglycols, including five new trihydroxy polypropylene glycols.

## HANDLING SPEED

A case history of how one of the world's three largest liquor wholesalers increased the speed of the materials handling operation in its warehouse by 75 per cent has been made available by Lewis-Shepard Products, Inc., Dept. PVP, 125 Walnut St., Watertown 72, Mass.

The six-page presentation, designated as Case History Bulletin 509-1, describes and pictures the complete handling cycle in this unique west coast warehouse, from receiving to storage to shipping.

## POLARIMETRIC ADAPTER

Bulletin #330 has been made available by the Photovolt Corp., Dep. PVP, 95 Madison Ave., New York 16, N.Y.

The bulletin describes the Lumetron photoelectric polarimeter model 402-EP as well as the adapter by means of which every existing Lumetron photoelectric colorimeter model 402-E can be made to perform polarimetric measurements.

Principle of operation, applications, descriptions, price list, and accessories are outlined.

## HOUSE PAINT PRIMERS

A 12-page brochure, "House Paint Primers Are All Important," has been made available by the

Eagle-Picher Co., Chemical Division, Dept. PVP, American Building, Cincinnati 1, Ohio.

The bulletin restates and reviews the importance of primer coats in successful painting of houses and buildings.

Maintenance problems, tests, and functions are outlined. Panels and pictures are included.

## TERPENE POLYMERS

Piccolyte resins—pale, non-yellowing terpene polymers which are available in solid or solution form—is the subject of a new eight-page bulletin published by Pennsylvania Industrial Chemical Corp., Dept. PVP, Clairton, Pa.

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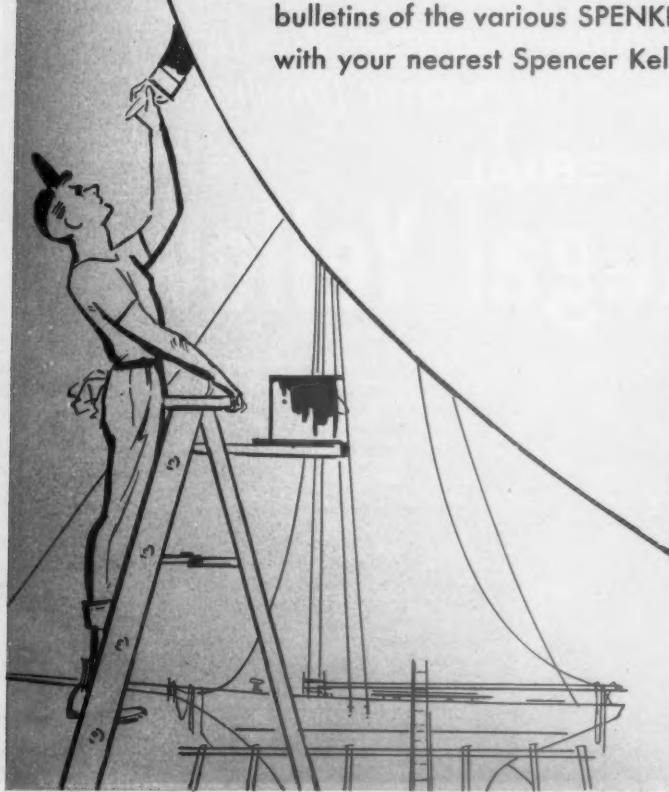
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**New Studies in  
Germany and England**

**Soviet and Polish  
Abstracts**

## Germany

### Effect of PVC on Film Properties Pigment for Anti-corrosion Paints

## England

### Titanium Esters in Paints Radioactive Materials in Paints

TWO interesting studies - one concerned with the effect of pigment-volume-concentration on the film properties of paints and the other on the effect of pigments in anti-corrosion coatings—were recently made in Germany.

R. Haug discusses pigment-volume concentration (PVC)—defined as the relation of binder and pigment content in paint—and methods of determining the critical pigment-volume concentration (CPVC). The latter is defined as that PVC at which there is just enough solid binder to fill out the space between pigment particles. Certain film properties exhibit an abrupt change at or near CPVC (water resistance, gloss, tendency to blistering, rust formation). The "cell method" of Asbeck and van Loo is reliable for the determination of CPVC, irrespective of pigment dispersion; the values, which vary with the binder, are valid for a broad range of pigment-binder relationships. Filtration difficulties may occur even with careful use of solvent for facilitating binder-extraction from pigment; this may be overcome by employing the centrifugal method for CPVC determination. The latter, as tested on lacquers pigmented with red iron oxide and talc and using a resin as binder, consists of centrifuging samples (20 g) of lacquer, diluted with butyl acetate, at 3,000

rpm for 20 min.; after decantation, mixing the residue with 5-10 ml butyl acetate in a graduated tube, and centrifuging twice for ten minutes at the same speed; sediment volume was then read off. By comparison with the cell method, the centrifugal method showed: uniformity of results; poor particle packing (pure iron oxide exhibited highest CPVC). Since the cell method is unsuitable for the determination of CPVC of emulsion and dispersion paints, indirect use of film properties has been employed by Becker and Howell, a technique similar to Asbeck and van Loo's method of estimating film-permeability dependence on pigment-binder content. Becker and Howell made use of tensile strength, stiffness and elongation of films; enamel holdout and washability were found less suitable for the purpose. On the tensile strength curve, the CPVC value appears at the maximum. Haug found a similar relationship with the film-hardness curves, while the electrical conductivity curve showed a turning point at CPVC value. The Stackelberg and Frangen method of determining "wetting volume" of pigment by liquids (defined as volume of liquid fully saturating 1 g of loosely shaken powder) may be adopted for CPVC determination. "Wetting-volume" values, converted to corresponding PVC

values, are in agreement with CPVC values (obtained by suspending pigments in a solvent, filtering off the suspension and determining the CPVC of pigment cake); i.e., the "wetting volume" of a pigment represents its CPVC for a particular solvent. Investigation of blister formation in multi-coat systems has shown that the base coat must be higher in pigment, to balance the increase in binder content when the top coat is applied. The PVC of ground and top coats in multi-layer coats should be established successively, if optimum film properties are desired.

J. D'Ans and H. J. Schuster J. describe some of the more important effects of pigments in anti-corrosion coatings. As fillers, pigments exhibit simple physical effects: they lower the diffusion rate of water and oxygen, increase the mechanical strength of the coating, impair elasticity and plasticity. The chemically inert pigments which react with neither the paint binder, its decomposition products, the metal base, nor the atmosphere, still play a role in corrosion protection. Their particle size, and the nature of their surface affect the coating properties: the relatively large surface area of flat-like pigments (mostly inorganic), which facilitates the formation of binder

molecules into parallel strata, causes a prolongation of the diffusion path, and by closer particle packing renders the film more impermeable. Particle crushing produces surfaces with high activity, with a tendency toward re-crystallization. Presence of foreign matter on pigment surface affects film adhesion. Schuster made use of the electron microscope in observing the tendency of some substances to grow on substrates. Soluble impurities in pigments increase the electrical conductivity of the coating, thereby aiding corrosion; particularly dangerous are the acidic substances present, either as impurities or products by oxidation. The beneficial effect of weakly basic, difficultly soluble pigments such as zinc oxide or barium carbonate, which not only neutralize the acidic substances but raise the pH of the wet coating above the neutral, has been established. The chemical and electrochemical effects of pigments cause a change in the chemical nature of red lead and zinc powder; at the point of contact between metal and coating, pigment transformation products form a "layer" whose poor conductivity retards corrosion. Especially hard "layers" are formed by aluminum, chromium and tantalum, while iron is an exception. The corrosion-inhibiting properties of lead cyanamide and of other pigments increase when these substances are part of the electrochemical processes of the corroding elements. Pigments are capable of oxidizing  $Fe^{II}$  to  $Fe^{III}$ ; with transformations which do not entail a change of valency, pigments do not act as corrosion inhibitors. The preparation of a pigment capable of inhibiting rust, from a lead solution, and of exceptionally fine particle size, is reported by the authors. Such a pigment may have no metallic conductivity. The corrosion-inhibiting behavior of chromates in wash primers is enhanced by phosphoric acid; the latter forms difficultly soluble layers of basic phosphates, and releases chromic acid, which in turn is reduced to chromium hydroxide, also capable of layer formation. Formation of new, basic metal compounds on the base surface appears to improve the corrosion-inhibiting properties of the film.

ORGANIC titanates have been given wide-spread attention in paint application. Recent work in England indicates that these compounds have possibilities in enhancing film properties of alkyd paints and impart certain rheological characteristics to paint systems.

As regards the titanates generally, the reaction of titanium esters with water results in hydrolysis and is accompanied by condensation. This means that precautions must be observed in using such materials. Thus, undue exposure to atmosphere is to be avoided. The susceptibility to hydrolysis varies with different compounds; for example, in the series of derivatives of aliphatic alcohols, increase in molecular weight retards hydrolysis. Moreover, certain titanium derivatives of glycols give greater hydrolytic stability, although with the lower glycols polymer formation may take place (the products of such formation being powdery solids of no interest). But with 2-methylpentane 2:4-diol and 2-ethylhexane-1:3-dioldervatives can be formed as soluble solids of definite melting point; these are remarkably stable towards hydrolysis and their solutions appear unaffected by atmospheric pressures over a long time.

Organic titanium compounds form interesting co-ordination substances; if this is carried out with chelating agents, the resultant products may be very stable. Some titanium compounds with chelate structure are water-soluble- i. e., triethanolamine titanate and titanium lactate. Acylates of the titanium compounds are much more stable to hydrolysis than the alkoxides.

Sidlow discusses in detail the properties of butyl titanate. Its interesting possibilities as an anti-oxidant are being investigated: tests not yet completed indicate that incorporation of small amounts of butyl titanate in alkyd paints reduce the amount of fading and improves gloss retention. Tests are also being conducted on a copal-linseed oil varnish. It is pointed out that an obvious outlet for this anti-oxidant effect of butyl titanate is as an anti-skimming agent, and some tests are cited to prove the feasibility of this use.

Control of skimming was, however, accompanied by some loss of normal drying properties.

It seems probable that skimming can be reduced or even eliminated by addition of butyl titanium in small percentages. Some yellowing of white paints is caused by such additions, but the effect in colored pigments is hardly noticeable.

Titanium esters effect the rheology of paint systems, either by increasing or decreasing viscosity, so that gelling may occur; for example, with brown linseed oil, gelation is marked: even at 0.25% slight gelling occurs, and at 4% a hard gel is obtained. There is some reason to believe that the anti-oxidant effect of the titanium works in opposition to the gelling effect.

The effect of the additions of butyl titanate on the grinding properties of pigments in various media is discussed. With linseed oil, the effect of addition varied from an increased ease of dispersion to no effect at all; in a few cases the butyl titanate slightly impaired dispersion. These differences varied with the pigment used. Other pigment useds were examined in linseed stand oil and a long pentaerythritol alkyd: the effects of addition of butyl titanate were less pronounced than with varnish linseed oil. It was concluded that the effect of butyl titanate on pigment dispersion is specific to particular combinations of pigment and medium.

The dispersive effect of butyl titanate increases with the amount used, but with oleoresinous media addition is limited by gelling and anti-oxidant effects of the titanate. It is notable that these effects are missing in hydrocarbon printing oils, so that larger amounts of butyl titanate can be added and greater dispersion achieved. (It has also been suggested that titanium may reduce the drying time of printing inks.)

The tests just described show, interestingly, that thixotropy of dispersions of several pigments in linseed oil and varnish linseed oil may be markedly reduced by addition of butyl titanate; even 0.3% of the titanate on the weight of pigment had some effect. So far, pigment dispersions made in

stand oil or alkyd media have been thin-flowing liquids with no evidence of thixotropy. Heavier pigments are being investigated.

Another possible use of titanium compounds is as plasticizers for urea and melamine formaldehyde resins. Oleyl and cyclohexyl titanate have been found compatible. If titanium compounds are used in place of non-drying alkyds some properties are improved; i. e., the tendency to striation is reduced.

Titanium esters may be used as curing agents for silicone resins, low temperature curing being possible with such esters. They appear also to be useful as transesterification catalysts, and for preparation of polyesters, or more particularly, polycarbonates, beginning with a simple diester and transesterifying with a glycol.

THE incorporation of radioactive materials into marine paints to inhibit fouling was recently investigated in England. Studies were made on the use of thallium isotope,  $Tl^{204}$  in this particular application. Major considerations in the use of any such isotope are: its safety, half-life, solubility, ease of incorporation, vehicle and cost. For health reasons, isotopes should be limited to the pure  $\beta$ -emitters, whose emission is of limited range in air. A half-life of about three years is considered reasonable. The element must be highly insoluble in sea-water; an element occurring in the water at very low concentrations is thus advisable.

To fill these requirements,  $Tl^{204}$  was selected. Its half-life is about four years, energy 0.76 Mev. It was used as a highly insoluble sesquioxide. The vehicle used was based on coumarone and asphaltum with tung and linseed oils, highly pigmented with carbon black.

A series of tests is described, using the radioactive thallium isotope in four concentrations on painted aluminum panels, which were immersed about one fathom below sea level. After two months, most of the panels were covered with dense growth of green alga, but after three months this had disappeared and was replaced by a rich growth of sea-squirts and a few barnacles. Sea-squirts remained until panels were withdrawn after 11 months.

## SOVIET and POLISH ABSTRACTS

A recent analysis of the Soviet chemical literature indicates that the Russian are devoting considerable attention to basic studies in high molecular chemistry. Vinyl and styrene polymerization techniques have been investigated thoroughly. Of interest to the paint field, the Soviets have widely studied phenol formaldehyde and alkyd reactions. In the alkyd study the effect of various catalysts upon the reaction of glycerine and phthalic anhydride have been investigated plus the kinetics and mechanism of alkyd resin formation. Other work being carried on concerns silicone polymerization and synthesis.

Graft polymer are occupying the interest of Soviet resin technologists. A new method permitting the formation of graft copolymer materials on a polyamide surface was reported.

These investigation are a clear indication that the Soviets aim to develop a highly technical resin and plastics industry.

### Lacquer Particles of Alkyd Enamels

By I. A. Popova & R.D. Zamyslov, "Zhurnal Prikladnoi Khimii," 31:652-655, April 1958.

The so called lacquer dross, often found as element of the lacquer base and formed either during enamel manufacture or during its storage, presents a major problem. Having investigated its nature, the authors found that the dross of alkyd enamels consists in most cases of acid particles of the lacquer base formed as insoluble compounds during the reaction of acid radicals with heavy metals (manganese, iron, zinc etc.). Their formation starts during the preparation of alkyd lacquers, and continues during both the manufacture and storage of enamels. The particles act as nuclei, around which coagulate and harden minute pigment solids. Chemically, the lacquer dross represents alkyd resins with a higher content of phthalic anhydride. Both the low iodine number and the high hydroxyl number are characteristic of fatty acids which form the resins. These factors lower the dross solubility in petroleum and aromatic hydrocarbons, the common solvents utilized in the manufacture of alkyd lacquers and enamels. The formation of heavy metallic salts decrease this solubility even more. The ash content of the dross is six or seven times higher than that of the base. This circumstance points to the conclusion that catalysts and driers, employed during the manufacture of alkyd resins and enamels, play a large role in the formation of lacquer dross. The time, necessary for the "ripening" of the dross particles (which causes the enamel to lose practically all of its quality), was found to depend on the following factors: the initial size and quantity of the dross particles, their reactivity, and the intensity of the oxydation and polymerization processes

taking place during lacquer and enamel production. As a cause of the dross formation should be regarded the various unfavorable condition during technological synthesis of alkyd resins, such as uneven heating in apparatus of simplified construction, and to the facility with which unregulated side-processes of oxydation and polymerization may occur.

### Copolymers of Styrene and Methylacrylate

By A. Ia. Drinberg, B.M. Funbyler, & A.M. Frost, "Zhurnal Prikladnoi Khimii," Vol. 30, 5:771-777, 1958.

One way of improving the properties of polystyrol is by copolymerization of styrol with various monomers containing highly polar groups. The authors studied the effect of various factors on the process of polymerizing styrol with methylacrylate, and investigated the properties of coatings from that copolymer. The reaction between styrol and methylacrylate was found to proceed at an approximately equimolecular ratio of components, or with methylacrylate being in surplus in the reaction mixture. Copolymerization begins immediately upon heating the mixture: the viscosity and the refractive index of copolymers in the initial reaction stage change. The yield of copolymer increases with the increasing amount of methylacrylate in the starting mixture. An increase in the saponification number of the forming copolymer indicates its rapid thickening caused by the polymerizing methylacrylate. In comparison with coatings based on pure polystyrene, those based on copolymers of styrene with methylacrylate possess higher physico-mechanical properties. Films of lacquers, containing 15 per cent copolymer in toluol, dried completely in 24 hours. Tests showed these coats to have an increase resistance to impact, deflection and attrition.

## Soviet High Molecular Chemistry

Digest. Up to 1957.

Shostakovskii, who prepared large numbers of polymers of simple vinyl esters, studied the mechanism of polymerization of the latter (1952). Shorygin and Shorygina investigated polymers of styrol and its analogs, establishing the influence of the starting monomer composition upon the rate of polymerization (1935, 1939). Gutovskii, Berlin, Drinberg et al. studied the polymerization and copolymerization of various esters of metacrylic acid (1951). Polymerization of vinyl chloride and the properties of its polymer and copolymer were studied by Pavlovich, Rutovskii, Berlin, Drinberg et al. between 1945-53. Petrov, Bansheidt, Maksorov et al. investigated widely the phenol aldehyde resins, later exploited by the plastics industry. Petrov proposed a method of phenol condensation with formaldehyde in the presence of petroleum sulfo-acids, which was adopted industrially, in 1912; the thus obtained resins are called "carbolites." Both Berlin and Petrov widely studied, with others, resins based on formaldehyde and urea or other amides or amines. Maksorov, who studied the effect of various catalysts upon the reaction of glycerine with phthalic anhydride, determined which catalysts accelerate the reaction and which darken or decompose the product. Wide study of alkyd resins has been carried out. Kiselev, Kogan, Shkol'man and others investigated the kinetics of formation and mechanism of formation of glyphthalic resins. The condensation of xylanol with phthalic anhydride was tested by Kiselev, and Petrov with Vlasova investigated the possibility of resin formation from pentaerythrite and phthalic anhydride. Korshak and Vinogradova studied linear polyesters, together with Frunze (1957), obtained by polycondensation of dicarboxylic acids with glycols, and suggested the relationship and effect of composition upon properties. Polyamides of various composition, obtained by polycondensation, were synthesized in large quantities. The kinetics of polyamidation of hexamethylene diamine with cebasis acid was studied by Chelnokova et al. who found the reaction to proceed as a bimolecular one, with an activation energy of 24,000 cal per mol. Organo-silicic compounds, first described by Andrianov in 1946, led to the development of silicopolymers. Shorinnyi and his pupils spent great deal of time studying the chemistry of cellulose.

Korotkov and others studied polymerization of isoprene, divinyl, methylmethacrylate, copolymerization of styrene in the presence of various organometallic compounds of lithium and sodium. Polymerization processes of

ethylene and propylene in presence of alumino organic compounds were studied; many followed the polymerization laws in various emulsion systems; the mechanism of the polymerization-in-emulsion process was learned, effect of the nature and amount of agent.

### Preparing Graft Copolymers

By V.V. Korshak & K.K. Mozgova, "Izvestia Akademii Nauk USSR, Otdelenie Khimicheskikh Nauk," 5:651, 1958.

A new method is reported which permits the formation of graft copolymer layer on the surface of polyamides. The formation of inoculated polymer macromolecules is initiated by a preliminary formation of peroxide groups on the polyamide surface. In the experiments described, polyamide films were treated with ozone and a vinyl monomer; a layer of polystyrol or another polymer formed on the surface of the polyamide film, and it did not dissolve even after hours of heating with a solvent. The weight and thickness of the inoculated polymer layer varied according to the length of ozone treatment. Process conditions and length of time of treatment were found to influence the mechanical properties of the film. The work was carried out as the Institute of Element-Organic Compounds, Moscow.

### Polyisobutylene for Anti-Corrosion

By B.N. Gulieva & A.V. Zhdanova, "Gidroliznaya i Lesokhimicheskaya Promyshlennost," 1:8-9, 1958.

Polyisobutylene, for years used for apparatus-protective coatings in the Soviet Union, is proposed as an anti-corrosion agent in the wood chemistry and hydrolysis industries. The most commonly used polyisobutylene in the USSR has molecular weight around 200,000, and is produced industrially in sheets of 800 x 3000 x 2.5-3.0 mm. The authors discuss the properties and method of application for anti-corrosive coatings of polyisobutylene.

### Reactions of Epoxy Resins with Phenolics

By S. Penczek, "Przemysl Chemiczny," 37:35-38, 1958.

Investigation of the chemical processes occurring during the hardening of epoxy and phenol-formaldehyde resins. In reaction conditions, the hardening process of phenol-formaldehyde resins is determined by the reaction between phenol groups; that of the epoxy resins, by the reaction of epoxy groups. Preparation was attempted of new types of

polyethers of especially high molecular weight from diphenols and diepoxy compounds, using diglyceride ethers of resorcin and hydroquinone, and diphenols. The maximum molecular weight did not exceed 7,000. Upon studying the hardening of polyphenols with diglyceride ethers, the optimum properties (highest cross-linkage determined by heat resistance and percentage of soluble part of gel) were found at the minimum ratio, needed for total hardening, of epoxy to phenol groups. When polyphenol and epoxy resins were melted, the electrical properties of the product (in comparison with pure epoxy resins) were found not to have deteriorated significantly; the stability of the liquid composition at high temperatures depends on temperature

### Hydration of Soybean and Linseed Oils

By G.I. Baglai, E.G. Patkanov, V.P. Rzhevkin, & E.A. Semenov, "Maslobino Zhirovaya Promyshlennost," 27:7-9, April 1958.

The phosphorus-containing impurities in linseed and soybean oil are known to present difficulties, if their removal is attempted by hydration with water or electrodes. The authors describe a method of successful continuous hydration of soybean and linseed oil, proposed in 1957 by a Dnepropetrovsk scientific institute, and its application for the preparation of phosphatide concentrate. The hydrated oils have a minimum contents of phosphorus-containing impurities and of other ash elements. The results are tabulated.

### Water-Soluble Resins in Latex Mixtures

By P. Liudvig, M.S. Monastyrskaya, S.A. Pavlov, G.K. Koshman, & V.M. Chesunov, "Legkaya Promyshlennost," Vol. 18, 5:22-26, 1958.

Some results are reported on the 1957 investigation by the Moscow technological institute of the light industry of introducing resins in aqueous phase into latex SKS-30 and DVKhB-70. The purpose of the study was the preparation of harder films from those latex compounds, and with greater adhesive powers; the substitution of stabilizer (casein) was also sought. Strength of latex films was increased upon addition to the latex of resorcin-formaldehyde or melamine-formaldehyde resins (one product: 112 kg/cm<sup>2</sup>). Glyphthalic resin was found to increase the strength of the film, and to act as stabilizer. Research carried out at the "Kozhimit" plant indicated that the use of glyphthalic resin as the stabilizing agent of latex mixtures permits to completely eliminate casein from the coating composition.

# NEWS

NEWS OF COMPANIES, ASSOCIATIONS  
TECHNICAL GROUPS  
ITEMS OF GENERAL INTEREST

## Paint Trade Sales At All Time High

Trade sales of the paint industry in May were at the highest dollar level for any month in history, totaling \$106,300,000, it is announced by General Joseph F. Battley, president of the National Paint, Varnish and Lacquer Association. This is the first time sales have exceeded \$100,000,000 in any month. The latest figure is 11.7 per cent above the April total and 8.3 per cent above the previous record high month of May, 1957, when trade sales were \$95,200,000.

For the first five months of this year trade sales were \$406,175,000, up 2.8 per cent above the total for the first five months of 1957.

Total sales of the industry for May were \$158,600,000, an increase of 0.4 per cent from the May, 1957 figure of \$158,000,000 and were 9 per cent higher than the April score of \$145,500,000. For the five months ended May 31, total sales were \$645,809,000, off 4 per cent from the total of \$672,489,000 reached in the like 1957 period.

Sales of chemical coatings (the finishes applied by industrial manufacturers to their various products) increased 4 per cent in May to \$52,300,000 from the April total but were 12.6 per cent below the May, 1957 figure of \$59,849,000, reflecting lower production by the automotive, appliance, and other industries. For the five months, sales of chemical coatings were \$239,634,000, off 13.7 per cent from a year ago.

Total gallonage for May was estimated at 55,400,000, an increase of 10.4 per cent over April.

## Kohler Begins Construction

Construction has begun on a \$400,000 expansion designed to increase paint manufacturing capacity  $2\frac{1}{2}$  times at the Kohler-McLister Paint Company, Denver, Colorado. The step-up will be achieved by completely renovating and enlarging the factory itself, and by addition of a 90,000-gallon

tank farm to permit direct pumping of liquid raw materials into the factory.

The addition, which will also include new general offices, a new paint laboratory, and a new warehouse, is expected to be completed by January 1, according to Henry McLister, vice-president and general manager.

New factory facilities will include a plant to make polyvinyl acetate. This is the first such plant between the west coast and the Missouri River, and will enable Kohler-McLister to meet the sharply increased demand for its latex paints and give faster service to the firm's dealers in Colorado, Wyoming, New Mexico, Arizona, Kansas, Nebraska, South Dakota, Oklahoma, and Texas.

## Aniline Consolidates

In a move to emphasize and consolidate the research program of the dyestuff and chemical division of General Aniline & Film Corporation, the major section of the division's technical laboratory has

been transferred from 435 Hudson St. in New York to the Company's Central Research Laboratory in Easton, Pa.

In the main, the Hudson St. laboratory, which served both General Dyestuff Company and Antara Chemicals, will be integrated into an applications research and technical service function of the research department.

All of the laboratory's functions with the exception of that concerned with pigments and customer service in support of the New York-Philadelphia and export sales offices will be transferred to the Easton laboratory. The latter will be retained in New York and the pigment laboratory will be removed to the Company's Linden, N. J., plant.

The stepped up activity at Easton will result in a total of 36 new research functions there and the employee roster will be increased from 83 to 129, including chemists and supporting personnel.

At Linden, 6 new functions will be added, bringing the total there to 70. This integration of the pigment research activities points up the company's stepped up activity in the pigment market, which was spotlighted first with the formation of a special pigment department two years ago.



**HIGH-VISIBILITY AIRCRAFT FINISHES:** The move to paint aircraft with fluorescent material and distinctive colors as a safety measure has brought renewed interest in the hot spray method of refinishing planes, according to H.M. Kidd, vice president-sales of the DeVilbiss Co. Studies show that use of the hot spray equipment permits painting in any temperature conditions, saves time and material, and results in better looking, longer lasting paint jobs.

# NEWS

## SIPMHE Sponsors Technical Short Course

The important role played in industry and commerce by packaging, materials handling, warehousing and shipping management is reflected in the program for the 1958 Packaging, Handling and Shipping Technical Short Course that will be presented in Chicago, Oct. 13-15.

A total of 45 different topics presented at 16 different sessions will present an array of experts in the highly technical field, including faculty members of five major technical institutions of higher learning and representatives of many of the best known companies in the country.

The course will be sponsored by SIPMHE (Society of Industrial Packaging and Materials Handling Engineers) and will be presented by the University of Illinois, College of Engineering, Extension Division. Besides the U. of I., the faculty member-speakers will represent Ohio State U., Purdue U., Case Institute of Technology, and Illinois Institute of Technology.

The sessions of the Short course, each of which will be repeated to



**FIFTY YEAR CLUB PIN:** General Joseph F. Battley (second from right), president of the National Paint, Varnish & Lacquer Association, presents the association's Fifty Year Club Pin to M.J. Merkin, president of the M.J. Merkin Paint Co., at a recent testimonial dinner given in New York. Smiling their approval are two members of the dinner committee, Joseph A. Martino (left), president of National Lead Co., and Thomas J. Shanahan, president of Federation Bank & Trust Co., New York.

permit maximum attendance by registrants, will be presented at the Chicago Y.M.C.A. Hotel, close to the Chicago Coliseum where the 13th Annual Packaging, Handling and Shipping Show, also sponsored by SIPMHE, will be presented Oct. 14-16.

During the exposition, winners also will be decided in the annual National Championship Packaging and Materials Handling Competition. Professionals engaged in protective packaging, materials handling and shipping management in all types of industry in all parts of the country yearly participate in the competition.

Among the companies that will be presented by speakers at the Technical Short Course sessions are:

Sears Roebuck & Co., Montgomery Ward & Co., Sperry & Hutchinson Co., Reynolds Metals Co., Electromotive Division of the General Motors Corp., Bell and Howell Co., Continental Can Co., Proctor & Gamble Co., Johnson & Johnson Corp., Insurance Co. of North America, Stewart Warner Corp., Joseph T. Ryerson & Sons, Carson Pirie Scott & Co., Towmotor Corp., the Hyster Co., Nutting Truck and Caster Co., Rapids-Standard Corp., Motorola Inc., Central Fibre Products Co., and the Plastics Division of Ludlow Papers Inc.



**GOLD WATCH AWARDED:** Robert F. Leinberger, left, retiring Blackmer Pump Co. sales representative in the St. Louis, Mo. area, is presented with an inscribed gold watch by Elmer H. Lanthorn, right, Blackmer general sales manager, at a party for Mr. Leinberger held recently in St. Louis. Mr. Leinberger retires after 37 years with the company.

National headquarters are at 14 E. Jackson Blvd., Chicago 4, Ill.

### Schedule of Events:

October 13 thru October 15	SIPMHE Packaging, Handling, Shipping Short Course technical program begins. Y.M.C.A. Hotel, 826 S. Wabash Ave., under sponsorship of the University of Illinois, College of Mechanical Engineering, University Extension Division. 16 separate sessions will be repeated each day, to Noon, October 15—45 different topics presented by top notch speakers.
October 13	Packaging Institute (New York Annual Forum - Edgewater Beach Hotel.
October 13	Annual SIPMHE "Get Acquainted Party" Hotel Congress - 8:00 PM.
October 14 thru October 16	Chicago Coliseum - The National Industrial Packaging, Handling and Shipping Show. The National Championship Packaging and Materials Handling Competition and Awards Presentation.
October 14	P. I. Annual Awards Dinner - Edgewater Beach Hotel.
October 15 2:30- 4:00 P.M.	Joint SIPMHE - P. I. Educational Program - South Hall - Coliseum. A special feature that brings together these two technical organizations in a co-operative project.
October 16	Closing day - National Industrial Packaging, Handling and Shipping Show - Coliseum.
October 17	Hotel Morrison - SIPMHE National Board of Directors Meeting. The Society of Industrial Packaging and Materials Handling Engineers will hold its first Open Board Meeting.

# NEWS

## Rust Rate Survey Presented by Rust-Oleum

The comparative rates at which rust proceeds in different parts of the country have been exactly established for all United States cities over 10,000 population.

It takes three years, the fastest rate in the country, for rust to corrode a standard, uncoated steel test panel, the size of an auto license plate, in four different cities—Buffalo and Rochester, N.Y.; Erie, Pa.; and Miami, Fla. Slowest rust rate, more than 15 years, is in Tucson, Ariz.; Roswell and Santa Fe, N.M. In all the nation's major industrial centers, the rust rate is under four years.

This was disclosed in the first Rust Index of the United States, published by the Rust-Oleum Corp., Evanston, Ill. The index, the result of a 25-year research program, lists the 523 cities of the country with a population of more than 10,000 and the comparative rust rate for each city. Variations

in rate result from the different amounts of rainfall, wind, corrosive gases, sunlight, and salt water present in each locality.

The rust rate is three years, one month in Pittsburgh; three years, two months in Los Angeles; three years, three months in Cleveland; three years, five months in Chicago; three years, six months in New York City; three years, eight months in Philadelphia and Detroit; three years, nine months in San Francisco; and three years, ten months in Boston and St. Louis.

It is estimated that the nation's rust bill is currently about \$7½ billion per year, an increase of \$2 billion over the annual toll 10 years ago.

The index was compiled in a mammoth research program, in which dated and uncoated steel panels were left exposed at industrial sites throughout the country. The panels were of 28 gauge, low carbon, cold-roll sheet steel. Periodic examination of the panels provided the data for the Rust Index. The criterion for the Index was the time it took for the uncoated steel panel to rust to a severe degree.

Of the 523 cities listed, 221, or 42 per cent, were indexed as Class

I, meaning that uncoated test panels there rusted in less than four years. Class I rust cities include every major industrial area and most of the nation's secondary industrial centers.

In Class II, where test panels rusted in four to five years, there are 95 cities. The 316 cities in Classes I and II comprise 60 per cent of the nation's cities with population over 10,000.

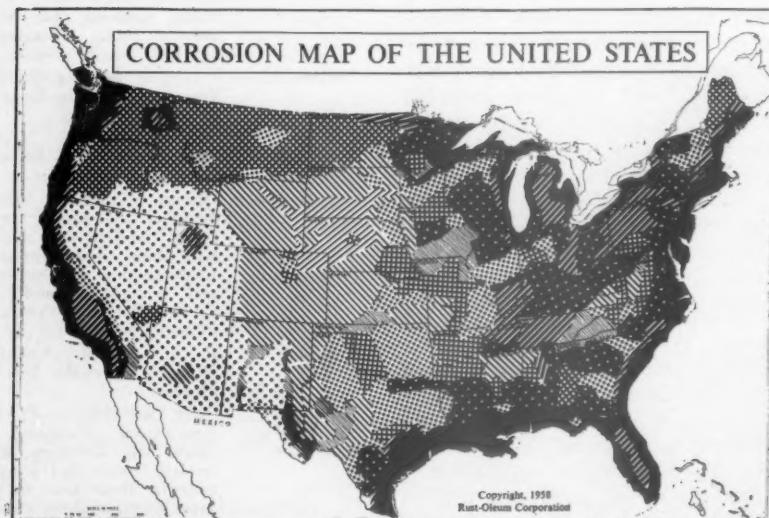
### THE 50 LEADING CITIES IN RUST LOSS

CITY	RUST INDEX Years-Months
1. Buffalo, N. Y.	3.00
2. Erie, Pa.	3.00
3. Miami, Fla.	3.00
4. Rochester, N. Y.	3.00
5. Mobile, Ala.	3.01
6. New Orleans, La.	3.01
7. Pensacola, Fla.	3.01
8. Pittsburgh, Pa.	3.01
9. Baton Rouge, La.	3.02
10. Lafayette, La.	3.02
11. Los Angeles, Calif.	3.02
12. Norfolk, Va.	3.02
13. Norristown, Pa.	3.02
14. Atlanta, Ga.	3.03
15. Atlantic City, N. J.	3.03
16. Baltimore, Md.	3.03
17. Cleveland, O.	3.03
18. Cleveland Heights, O.	3.03
19. East Cleveland, O.	3.03
20. Elyria, O.	3.03
21. Euclid, O.	3.03
22. Houston, Tex.	3.03
23. Johnstown, Pa.	3.03
24. Shaker Heights, O.	3.03
25. Youngstown, O.	3.03
26. Jacksonville, Fla.	3.04
27. Portland, Ore.	3.04
28. Providence, R. I.	3.04
29. Chicago, Ill.	3.05
30. Cicero, Ill.	3.05
31. Lakewood, O.	3.05
32. Lewiston, Me.	3.05
33. Milwaukee, Wis.	3.05
34. Portland, Me.	3.05
35. Seattle, Wash.	3.05
36. Sharon, Pa.	3.05
37. Wilkinsburg, Pa.	3.05
38. Bayonne, N. J.	3.06
39. Bellingham, Wash.	3.06
40. Galveston, Tex.	3.06
41. Lackawanna, N. Y.	3.06
42. Lake Charles, La.	3.06
43. Lockport, N. Y.	3.06
44. Manitowoc, Wis.	3.06
45. Newport, R. I.	3.06
46. Newport News, Va.	3.06
47. New York, N. Y.	3.06
48. Portsmouth, Va.	3.06
49. Reading, Pa.	3.06
50. Warwick, R. I.	3.06

### L.M. Porter Passes

Lee M. Porter, Boston regional trade sales manager of the Du Pont Company's Finishes Division, died recently at his home in Wellesley, Mass. He was 50 years old.

Mr. Porter joined Du Pont in 1935 as a paint salesman in Portland, Me. He was promoted to trade sales supervisor in 1948, and had been Boston regional trade sales manager since 1954.



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*Kentucky's*

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To reduce your C.P. grinding time, we recommend Kentucky's new Softex Chrome Greens. They provide exceptionally good resistance to darkening on exposure. The shades are bright—the strength good. If you want proof, request samples now.

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- No. 8946 CP Green, Dk.

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# NEWS

## Union Carbide Plans Epoxide Unit

Union Carbide Chemicals Company, division of Union Carbide Corporation, has announced a decision to proceed with an expanded version of a new unit at Institute, West Virginia to produce more than 10 million pounds per year of epoxides and other oxygenated chemicals. The unit will be completed in mid-1959.

Among the new products are Epoxide 201, vinylcyclohexene dioxide, vinylcyclohexene monoxide, dicyclopentadiene dioxide, styrene oxide, allyl epoxystearate, and caprolactone. These products are expected to play an important part in resin technology and to serve as chemical intermediates as well.

Special emphasis is to be placed on Epoxide 201, which forms plastic and coating resins of outstanding color stability and resistance to heat distortion. Epoxide 201 is more reactive to acid and anhydride hardeners than any other diepoxide. Vinylcyclohexene dioxide is a viscosity reducing agent for epoxy resins and performs its function without lowering the heat distortion temperature of conventional epoxy resins. Dicyclopentadiene dioxide forms resins of exceptionally high heat distortion temperature. Allyl epoxystearate can be used as a monomer.

In addition, Carbide expects to market two combination plasticizer-stabilizers for vinyl resins. This marks the first time that all-synthetic materials have been available for this purpose. The new materials are di-2-ethylhexyl epoxy tetrahydrophthalate and di-isodecyl epoxy tetrahydrophthalate.

Carbide will also use the new facilities for commercial custom epoxidation of materials which are either difficult or impossible to epoxidize with the usual chemical reagents.

vision of Dr. H. J. Kiefer, coordinator of research.

## Cyanamid Forms Department

Formation of a process chemicals department by the industrial chemicals division of American Cyanamid Company has been announced.

The new department, created through the merger of the company's heavy chemical and manufacturers chemicals departments, will service the wide range of industry's chemical needs with an extensive line of intermediate, heavy and specialty chemicals for the process industries.

Among the chemicals that will be handled by the new department are cyanamide and its derivatives—dicyandiamide and melamine—alum and acids, phthalic and maleic anhydride, surface active agents, cyanuric chloride and a wide range of other specialty chemicals.

Principal office and eastern regional headquarters of the process chemicals department will be in New York City. In addition, there will be a western regional headquarters in Chicago as well as sales offices in 17 key cities throughout the country.



**COLORIZER AWARDS CITATION FOR HOUSING DEVELOPMENT:** Senator Wallace F. Bennett, center, Colorizer paint founder, cites Washington builder Edward R. Carr for outstanding development of community of North Springfield, Virginia. Mr. Carey accepts citation on behalf of Mr. Carr as Miss Colorizer looks on with obvious approval.

## New Glidden Laboratory

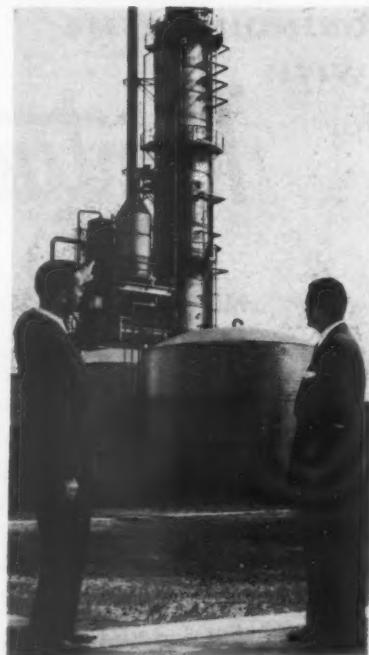
Establishment of a new plastics research and development laboratory in Cleveland has been announced by the Glidden Co.

Located at Glidden's Paint Division Research Center at 12430 Elmwood Avenue, the new plastics laboratory becomes part of an overall company effort to centralize all research and development work on new products. Integrated with other research groups of Glidden's paint division, the combined groups will utilize the increasing similarities of paint and plastics to improve both lines of products.

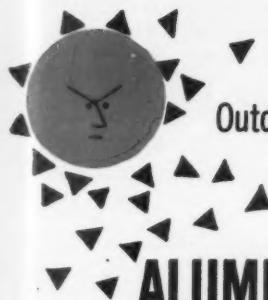
Facilities include the latest modern equipment to carry out development programs from the stage of synthesizing to compounding for various molding, laminating, casting, and coating operations.

Primary efforts at the new Glidden plastics laboratory will be devoted to research and development work in connection with the firm's Glidpol polyester resins for molding, casting, and coating operations; rigid polyurethane foams for insulating and structural applications under the brand name Glidfoam; and Glid-Rez butoxy resins for coating and casting.

The new laboratory, which will be staffed by personnel who were formerly engaged in plastics research at Glidden's regional laboratories, will be under the super-



**NEW CHEMICAL PRODUCTS DIVISION:** The Union Bag-Camp Paper Corp. has established a new chemical products division. Ellis O. Barnes, left, has been named manager of manufacturing and research, and A.B. Doran has been appointed general manager of the division.



Outdoor aluminum needs the protection of **Half-Second Butyrate lacquers**—

## **ALUMINUM VENTILATING LOUVERS, for example**



Aluminum louvers, protected from weathering by a coating of a Half-Second Butyrate lacquer, screen air conditioning intakes at base of Ford Motor Company's general office building, Dearborn, Michigan.

### **Clear, durable, weather-resistant Butyrate coating preserves original finish of aluminum louvers**

Aluminum, upon prolonged exposure to weather, suffers no structural damage, but its surface does develop an unattractive greyish-white oxide film. In many urban and industrial atmospheres, aluminum corrodes and pits—and the pits collect dirt and grime.

Faced with this problem, Construction Specialties, Inc., of Cranford, New Jersey, began a search for a coating to preserve the original appearance of its extruded aluminum exterior louvers and sunshades.

After extensive laboratory and field testing involving different types of protective coatings, they found the answer in a lacquer based on Eastman Half-Second Butyrate.

"Over two years' experience with Butyrate lacquer

has shown us that it will withstand the most rugged-on-the-job exposure with no visible deterioration," says E. C. Hallock, president of Construction Specialties. "A Half-Second Butyrate lacquer is now the standard protective coating for all our aluminum products."

Little maintenance is needed with Butyrate-coated aluminum. At most, surfaces may require occasional hosing.

Take advantage of the growing market being created by the expanded use of aluminum as an exterior material by offering Half-Second Butyrate lacquers. Ask your Eastman representative for more information.

A new 15-minute, 16mm. sound color film entitled "Half-Second Butyrate—a protective coating for exterior aluminum surfaces" is available without charge, for viewing by those interested in this market. Write to Eastman Chemical Products, Inc., subsidiary of Eastman Kodak Co., 260 Madison Ave., New York 16, N. Y.

## **HALF SECOND BUTYRATE**

an Eastman film former

**SALES OFFICES:** Eastman Chemical Products, Inc., Kingsport, Tennessee; New York City; Framingham, Mass.; Cincinnati; Cleveland; Chicago; St. Louis; Houston. **West Coast:** Wilson Meyer Co., San Francisco; Los Angeles; Portland; Salt Lake City; Seattle.

## PERSONNEL CHANGES

### KOPPERS

Walter P. Arnold has been elected an executive vice president, it has been announced.

Mr. Arnold, who became associated with the firm in 1925, has served as vice president and general manager of the company's wood preserving division since 1952.

Douglas Grymes, Jr. will succeed Mr. Arnold as vice president and general manager of the division.

### DU PONT

Roy A. Robichaud has been named railway finishes representative for the Atlanta regional sales office of the company's finishes division, it has been announced.

Mr. Robichaud was graduated from Boston College with a degree in chemistry in 1947 and, after a two-year period as a laboratory assistant, took his master's degree and joined the organization as a paint chemist.

### U.S. RUBBER

Dr. Thomas L. Wilson has been named manager of the research center in Wayne, N.J., it has been announced.

Dr. Wilson replaces Dr. Arthur E. Brooks, who was recently appointed an assistant director of the research and development department.

After obtaining a doctorate degree in chemistry from the University of Chicago, Dr. Wilson joined the company's general laboratories in 1935 as a research chemist. In 1954, he was named administrative assistant to the director of research and development, the post he held before receiving his new assignment.

### SPENCER KELLOGG

Robert H. Turve has been appointed technical service representative for the midwest district with headquarters in the company's Chicago office.

Mr. Turve succeeds Donald D. McCready who has been named west coast technical service representative.

R. H. Turve

Mr. Turve joined the organization in 1955 as a member of the technical service department.

He graduated from Northeastern University, Boston, in 1951, with a B.S. degree in chemical engineering.

### DIAMOND ALKALI

Promotion of four key executives to posts of broader management responsibility has been announced.

William H. McConnell, vice president—sales since 1953 and a veteran of 30 years' service in sales work with the company, has been named vice president—marketing.

He will focus his attention primarily on the expanding requirements of the firm's marketing and sales management, as well as other general management responsibilities.

Henry B. Clark, general manager of soda products division for the past two and one-half years, has become director of sales.

He will take over some of Mr. McConnell's former duties, holding responsibility for management of the company's nine branch sales offices and administration of its market planning program.

Mr. Clark has been with the firm for the past 24 years.

John W. Mantz, general manager of the silicate, detergent, calcium division since 1954, has been appointed general manager of the soda products division.

Mr. Mantz, with a record of 30 years' experience on the production side of the alkali industry, joined the firm in 1946 as assistant superintendent.

Samuel S. Savage has been appointed general manager of the international division.

Mr. Savage has been director of export sales for the past nine years. He previously was active in both domestic and export chemical sales work.

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with MASKIT #2

This guaranteed paint deodorant has proved its complete effectiveness in thousands of gallons of paint, varnish, enamel, lacquer thinners and other similar types of products.

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Amazingly economical, 1 lb. of Maskit #2 deodorizes 150 gallons of paint. Why not order a trial pound today and make your own tests? \$1.50 lb.



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Now with GELVA TS-66, the only completely new PVAc emulsion for gloss, you can easily manufacture high quality full and semi-gloss paints. And Shawinigan offers not just starting formulations but thoroughly tested working formulations.

The properties which overcome the limitations of all other PVAc emulsions used for gloss have been built into GELVA TS-66. Gloss paints based on GELVA TS-66 do not require special additives. Compounding is simple in regular emulsion paint equipment—GELVA TS-66 is the sole vehicle.

The development of GELVA TS-66 Emulsion is another graphic example of how Shawinigan's unsurpassed emulsion technology is at work for you. For working formulations and technical information on gloss paints write to Shawinigan Resins Corporation, Department 2210, Springfield 1, Mass.

**Paints formulated with GELVA TS-66 offer:**

No loss of gloss by aging either in can or on the wall  
High gloss—85-90% reflectance, 60° Head;  
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Paints have long shelf-life, are stable

Flexible, non-yellowing films

Plus all the other physical properties which go to make up a quality polyvinyl acetate based paint, such as good leveling and brushability, good pigment binding capacity and others.

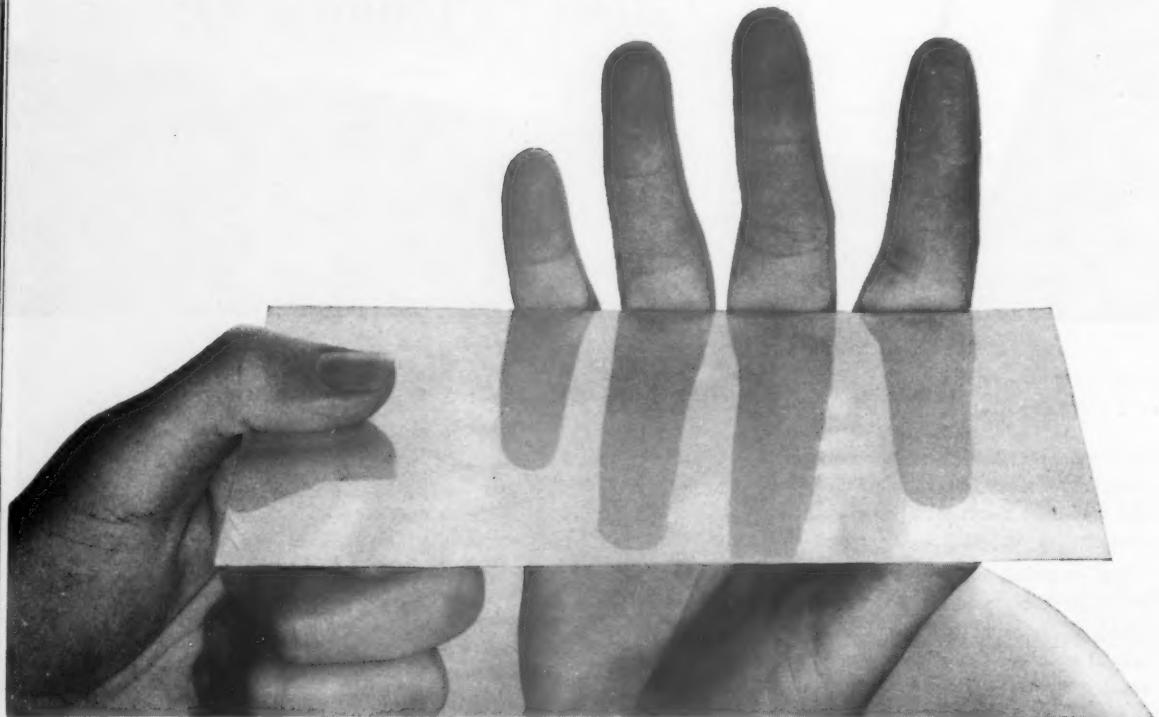
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**GELVA® emulsions for paints**



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For the maximum in gloss and gloss retention in industrial finishes, leading paint manufacturers rely on Du Pont Ti-Pure® R-110 titanium dioxide. This bright, rutile pigment also provides your industrial enamels and interior flats with excellent hiding power, good suspension and is easily tinted to bright, clean shades!

**RESISTANCE TO AFTER-YELLOWING** . . . Ti-Pure® R-110 assures continued high performance in both baked and air-dried enamels. Finishes for refrigerators and kitchen appliances resist discoloration . . . retain excellent gloss . . . meet critical customer standards.

**DU PONT OFFERS YOU** the widest choice of titanium dioxide pigments. Included are sulfate process pigments such as Ti-Pure® R-110 for the ultimate in gloss and gloss retention . . . and, in addition, the new chloride process pigments, Ti-Pure® R-100 and R-500, which offer new formulating possibilities in your industrial finishes.

**UNMATCHED TECHNICAL SERVICE** is available from Du Pont to help you solve a pigmenting problem. Both interior and ex-

terior exposure histories on a wide range of formulations are available at the Pigments Department new laboratory and test farm. For more information, call your Du Pont Pigments Representative, or write: E. I. du Pont de Nemours & Co. (Inc.), Pigments Department, Wilmington 98, Del. In Canada: Du Pont Company of Canada (1956) Limited, P.O. Box 660, Montreal, Quebec.

*In addition to a complete line of  
TI-PURE® titanium dioxide pigments, Du Pont  
offers a broad range of pigment colors:*

MONASTRAL® Blues and Greens	Zinc Yellows
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Molybdate Orange	Parachlor Red
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Organic Yellow	BON Reds and Maroon
Chrome Yellows	

and a complete line of Water-Dispersed Paste Colors.

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The 4 pure chromium oxides will withstand ceramic temperatures. Use them in applications requiring permanency—enamels, emulsion paints, rubber, plastics, floor coverings, roofing granules, building materials, etc.

Use the 2 hydrated chromium oxides for obtaining brilliant color and transparency in automotive finishes, high grade enamels and lacquers.

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#### AMSCO

**Frank A. Nalbach** has been appointed assistant eastern sales manager, it has been announced.



**F. A.  
Nalbach**

He succeeds **Richard V. Hinman** who was recently named eastern sales manager. Mr. Nalbach joined the firm in 1947. After becoming a sales representative, he was appointed assistant sales manager of the metropolitan division, responsible for the marketing of the company's line of industrial solvents and related chemicals.

He attended Manhattan College and Colgate University.

#### ATLAS POWER

The board of directors has announced several major changes among top-level personnel, including the election of **Ralph K. Gottshall** as chairman of the board, in addition to re-election as president.

As chairman of the board, Mr. Gottshall succeeds **Isaac Fogg**, who has retired after nearly 46 years of service.

The board also announced the election of **Edward J. Goett**, senior vice president, to the position of executive vice president.

Other changes announced included:

**Edward J. Massaglia**, general manager for operations of the chemicals division, elected vice president and general manager of the newly-consolidated chemicals division.

**Robert J. Reilly**, assistant treasurer, elected treasurer and secretary, succeeding **Preston W. Parvis**, who has retired after more than 47 years of service.

**John H. Leary**, assistant to the president, elected assistant treasurer and assistant secretary.

**Norman E. Miller**, company controller, elected an officer.

Officers re-elected were vice presidents **James R. Frorer**, **Charles C. Gammons**, and **William C. Lytle**; and **Arnold J. Fiedler**, assistant treasurer and assistant secretary.

#### NOPCO

**Robert J. Kingsley** has been named to the newly created position of general sales manager for the Pacific division.

In addition to his new duties, Mr. Kingsley will continue in the capacity of sales manager for the fine chemicals division.

As general sales manager, he will be in charge of the new expanded sales program and the administration and direction of sales efforts for all of the company's sales divisions in the eleven western states.

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Linoleate Liquids	Pastals

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Linoleate Solids	

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Lorraine 2-6250

### HOUSTON

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Phone: Walnut 3-1627

### LOS ANGELES

3237 So. Garfield Ave.  
Phone: Raymond 3-3161

### PHILADELPHIA

Jackson & Swanson Sts.  
Phone: Howard 2-4700

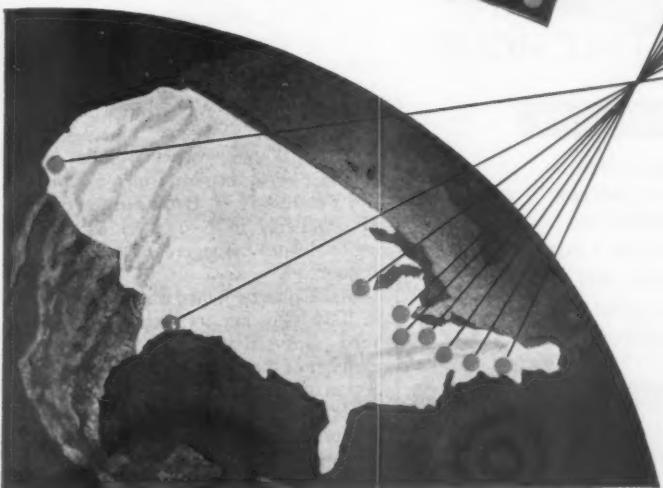
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## VULCAN STEEL CONTAINER

**Cothran C. Graves** has been appointed to the position of southeastern regional sales manager and **Fred L. Morris** has been named sales-service representative, it has been announced.



C. G.  
Graves



F. L.  
Morris

Mr. Graves is a Princeton graduate and has been in the steel pail and drum business for the past 17 years. He will make his headquarters at the company's main office and plant in Birmingham, Ala.

Prior to joining the firm, Mr. Morris was associated with U.S. Steel.

He attended the University of Alabama and received his degree in commerce and business administration.

## CONTINENTAL CAN

**Walter P. Murray** has been appointed to the newly created position of executive representative of the eastern metal division, it has been announced.

Having been with the firm for the past 34 years, Mr. Murray will devote his time to executive contact in the industries served by the division.

**George F. Henschel** has become sales manager of the eastern metal division, succeeding Mr. Murray, it has also been announced.

Mr. Henschel brings to this position a wealth of experience acquired in 28 years in the metal container industry.

## COLTON

**Colby Dill, Jr.** has become sales representative in the Philadelphia-Baltimore-Richmond-Washington, D.C. area, it has been announced.



C. Dill, Jr.

Following his graduation from Cornell University where he received his degree in chemistry, Mr. Dill joined Gates Engineering Co, where he was employed for four years. He was then with U.S. Rubber for three years in the motor products division and with Hercules Powder Co. in the synthetics division for three years handling sales of resins and plasticizers.

Mr. Dill will be headquartered at the firm's Elkton, Maryland office.

## COLTON CHEMICAL

**W.D. Meadows** has been appointed technical service representative in the west coast area, it has been announced.



W. D.  
Meadows

After attending Fenn College and Western Reserve University, Mr. Meadows was connected with paint manufacturing in the Cleveland area before joining Sherwin-Williams Co., where, for six years, he was employed as a paint chemist.

## GODFREY L. CABOT

**Donald Simonds**, previously midwestern regional sales manager, has been appointed to the newly created post of western regional sales manager with headquarters in Los Angeles, it has been announced.

Mr. Simonds graduated from Tufts University with a degree of B.S. in chemistry in 1937. He joined the firm in 1939 after completing research at Harvard University.

He has also served as assistant general sales manager and Akron office manager.

**Daniel B. Doherty** replaces Mr. Simonds as midwestern regional sales manager with headquarters in Akron and **Francis H.H. Browning** succeeds Mr. Doherty in New York as eastern regional sales manager, it has also been announced.

Mr. Doherty joined the organization in 1936 following graduation from Harvard University. He served as a member of the technical sales staff at the Akron office.

Mr. Browning attended Virginia Military Institute and University of Richmond Law School in 1935.

He was previously with E.I. du Pont de Nemours & Co., Inc., from 1938-1947.

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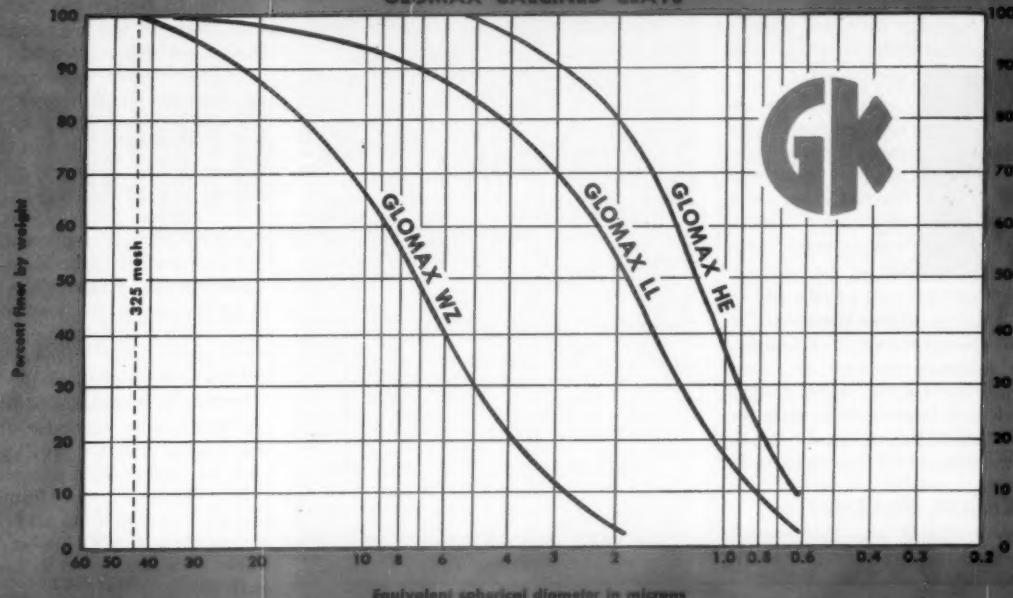
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Over 290 paints were formulated and tested in a recently completed study involving the GLOMAX Extender Pigments. They were used alone, in conjunction with Hydrite Kaolinates, and with prime white pigments.

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**GLOMAX LL**

**GLOMAX WZ**

Brightness (G. E. Meter)	90-92%	90-92%	80-82%
Moisture (maximum)	0.5%	0.5%	0.5%
pH Value @ 20% solids	5.5-6.5	5.5-6.5	5.0-6.0
Screen Residue (325 mesh-max.)	0.1%	0.1%	0.5%
Average Particle Size (microns)	1.2	1.8	7.0
Oil Absorption (Sputnik rub-out)	68-70%	46-48%	28-30%
Refractive Index	1.61	1.61	1.61
Bulking Value: 1 lb. bulk	0.0456 gals.	0.0456 gals.	0.0456 gals.
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 TORONTO, ONTARIO  
 VANCOUVER, BRITISH COLUMBIA  
 WINNIPEG, MANITOBA

## ALLIED CHEMICAL

Leon W. Miller has been named director of chemical sales for plastics and coal chemical division, it has been announced.



L. W.  
Miller

Mr. Miller's entire business life of more than 42 years has been spent with Barrett, from which the new division was recently formed.

A graduate of Ohio Wesleyan University, he joined Barrett as a building products salesman in 1916 at Cleveland. In 1930, he was transferred to New York and became sales manager, specialties department, and shortly thereafter manager of chemical sales.

## COMMERCIAL SOLVENTS

Albert P. Guill has been named western field representative for the

market development department, it has been announced.

Mr. Guill will be concerned with the development of new markets for the company's line of chemicals. He will make his headquarters at the district office at Los Angeles.

Mr. Guill joined the firm in 1954 and held the post of chief chemist of the Terre Haute plant since that time.

He received his M.S. in analytical chemistry from Oregon State College in 1950.

## CARBIC COLOR & CHEMICAL

Bruce O. Dickison has joined the firm, it has been announced.

Mr. Dickison will work out of the Providence office.

He is a graduate of the Lowell Technological Institute. Prior to joining the company, he was with Arnold, Hoffman & Co. in the midwest and with General Dyestuff Co. in Boston.

## VAN AMERIGEN-HAEBLER

Ralph C. Barley has joined the firm as manager of the engineering department, it has been announced.

Mr. Barley was formerly senior project engineer at American Cyanamid Co., and previously was associated with the Foster Wheeler Co. and the General Airline & Film Corp. in similar capacities.

Mr. Barley received his master's degree in chemical engineering from the Case Institute of Technology.

Bernard M. Mitzner has been named supervisor of the instrumental analysis section of the company's analytical department at Union Beach, N.J., it has also been announced.

In this new post, Mr. Mitzner will coordinate and supervise the use of instruments for the analysis of raw materials and finished products.

Mr. Mitzner was formerly with Lederle Laboratories, and previously was on the staff at Columbia University where he was engaged in instrumental analysis.

He received both his bachelor's and master's degree in physical chemistry at New York University.

## NEW JERSEY ZINC

Kenneth C. Lippmann has been appointed manager of transportation, it has been announced.

He succeeds K.L.R. Baird, general traffic manager, who has retired.

Mr. Lippmann, a veteran of over thirty years' service with the company, has been associated with the traffic department since 1929. He was named assistant to general traffic manager in 1946.

Alfred M. Blomquist and Daniel H. Vogel have been appointed assistant managers of transportation, it has also been announced.

In addition, William S. Hutchings becomes assistant manager of purchasing, succeeding Albert E. Turner, who has retired.

## AMOCO

Dr. A. James Skey has become marketing representative and will be permanently located in London, England, it has been announced.

Before joining the firm several months ago, Dr. Skey was associated with the British Oxygen Co.

Dr. Skey received his Ph.D. degree from McGill University in Montreal in 1939.

He has held a number of positions in industry and government including assistant technical director for the Canadian Liquid Air Co., Ltd. and technical and scientific representative in London for the Canadian Defense Department.

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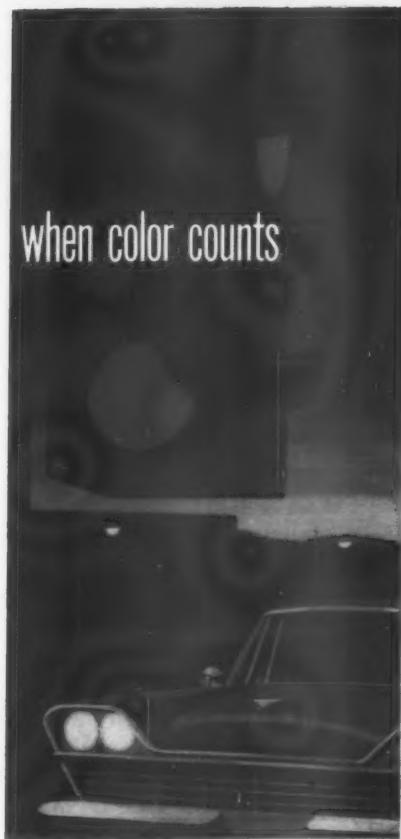
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## UNION CARBIDE CHEMICALS

Dr. Frank E. Critchfield and Lloyd H. Wartman have been appointed group leaders in the development department at South Charleston, it has been announced.

Dr. Critchfield was promoted from chemist to group leader. In his new position, he will be in charge of development work on chemical methods of analysis.

Dr. Critchfield received his B.S., M.S., and Ph.D. from West Virginia University. He joined the firm in 1953.

Mr. Wartman was transferred from the development department of Bakelite Co. to his present position.

In his new post, Mr. Wartman will be in charge of product development work on polyolefines.

He received his M.S. degree in chemistry from Polytechnic Institute of Brooklyn in 1943.

Two chemical engineers were also transferred from Bakelite Co. to the firm's development department. The engineers are R.E. Frayer and A.M. Gross.

## HEYDEN NEWPORT

Elmer Smith has been named sales manager of the American Plastics Corp., a subsidiary of the firm, it has been announced.

Mr. Smith has had 15 years of experience with the company in various sales, development, and production capacities.

Most recently, he has engaged in market development for the newer organic chemicals.

Mr. Smith received an A.B. degree in 1940 and an M.S. in 1942, both from Lehigh University.

## PENNSALT

William M. Lee has been appointed to the post of assistant to the vice president and technical director, it has been announced.

Mr. Lee has been associated with the firm since 1947, serving first as supervisor of the product development department, and later as manager of the sales services department.

He received his B.S. degree in chemistry from the University of Pennsylvania in 1927.

Prior to joining the firm, Mr. Lee was chief chemist for Thomas M. Royal Co., research director for Arabol Manufacturing Co., and chief of the chemicals and plastics section of the War Department's Office of Quartermaster General.

## INTERNATIONAL COATINGS

H.I. Silversher has been appointed technical director, it has been announced.

Mr. Silversher was formerly a consultant on plastics and adhesives in the Los Angeles area.

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THE PUFFING AGENT USED MORE BY MORE PAINT COMPANIES

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STERLING BUILDING

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## NEWS

### Maleic Anhydride Plant in Italy

Ftalital S.p.A., Milano, Italy, will build a 2,200,000 pound per year maleic anhydride plant at Scanzorosciate (Bergamo), Italy, the first to be built in that country. Scientific Design Company, Inc., and an affiliated company, Societe Francaise des Services Techniques S.a.r.l., Paris, France, will furnish the process engineering and major equipment design for the new plant as well as the necessary technical liaison.

Maleic anhydride is an important organic chemical used in the manufacture of alkyd resins, polyester resins, fungicides, plasticizers, and numerous specialty chemicals. As a chemical, it is very corrosive and difficult to manufacture.

The SD process produces maleic anhydride by continuous, catalytic, vapor-phase air oxidation of benzene. A patented catalyst and special design features are incorporated in the highly efficient process. The Ftalital plant represents the fourth maleic anhydride plant project undertaken by SD. Others are the plants of Reichhold Chemicals, Inc., Elizabeth, N.J.; Compagnie Francaise des Matieres Colorantes (Francolor), Villers-St. Paul, France; and the plant now under construction for American Cyanamid Company at Bridgeville, Pa.

Ftalital, according to managing director Baron Adolfo van Lamswerde and general manager Dr. Uberto Sabetta, is the leading European manufacturer of phthalic anhydride, with a capacity of 37,400,000 pounds per year.

### Sales Representative Named

Appointment of Roberts-McMillin Company as sales representatives for Herman Hockmeyer & Co., manufacturers of mixing machines for the paint, ink, and chemical fields, was recently announced.

Located at 95 Market Street, Oakland 7, California, Roberts-McMillin will serve the San Francisco—Northern California area.

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and  
**BUYERS'**  
**GUIDE**

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Annual Review of  
Developments in the  
Paint Industry

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Paint Industry

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ary 15th. Forms close Janu-  
ary 31st. Publication Date:  
March 1st.

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- 3 FOREIGN DEPARTMENT—new section with its own Foreign Editor & overseas correspondents — which gives paint manufacturers an inside look at the paint industry in Europe and Asia.
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### OF THE MEN WHO SPECIFY AND BUY!

#### PRIMARY CIRCULATION

Manufacturers of Paint, Varnish, Lacquer and other synthetic coatings and finishes .....	3,769
Total Primary Circulation.....	3,769

#### SECONDARY CIRCULATION

Manufacturers of raw materials for the paint industry .....	467
Wholesalers and retailers .....	31
Manufacturers' agents, brokers, and importers .....	26
Libraries and schools .....	78
Bulk .....	26
Research organizations and associations and laboratories .....	101
Government installations .....	45
Consultants .....	37
All other manufacturers not classified above .....	97
Total Secondary Circulation.....	908

NOTE: ONLY PORTIONS OF PAR. 10, BPA  
AUDITED PUBLISHER'S STATEMENT  
BASED ON JUNE 1958 ISSUE ARE  
USED ABOVE.

GRAND TOTAL..... 4,677

## PAINT and VARNISH Production

Formerly Paint & Varnish Production Manager  
Established 1910

*The Technical Magazine for Manufacturers of Paint,  
Varnishes, Lacquers and other Synthetic Coatings.*

In order to qualify, recipients must be management, administrative, technical and production men who are concerned with research, formulation and production in the paint and allied coatings field.

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**INSERTS FURNISHED:** Space Rates Apply; Back-up Charge \$75.00 per page Net. **CLOSING DATES:** Forms close 10th preceding month for regular monthly issues; January 31st for REVIEW & BUYERS' GUIDE.

**MECHANICAL REQUIREMENTS:** Halftones, 120 screen. All plates must be blocked. All copy and cuts must be within the following measurements: page 7<sup>1</sup>/<sub>2</sub> x 10<sup>1</sup>/<sub>2</sub>; two-thirds page, 4<sup>1</sup>/<sub>2</sub> x 10<sup>1</sup>/<sub>2</sub>; island-half page, 4<sup>1</sup>/<sub>2</sub> wide x 6<sup>1</sup>/<sub>2</sub> deep; half-page, 7<sup>1</sup>/<sub>2</sub> x 4<sup>1</sup>/<sub>2</sub>, 3<sup>1</sup>/<sub>2</sub> x 10<sup>1</sup>/<sub>2</sub>; one-third page, 4<sup>1</sup>/<sub>2</sub> x 4<sup>1</sup>/<sub>2</sub>, 2<sup>1</sup>/<sub>2</sub> x 10<sup>1</sup>/<sub>2</sub>; quarter-page, 3<sup>1</sup>/<sub>2</sub> x 4<sup>1</sup>/<sub>2</sub>; one-sixth page, 2<sup>1</sup>/<sub>2</sub> x 4<sup>1</sup>/<sub>2</sub>. (Trim size: 8<sup>1</sup>/<sub>2</sub> x 11<sup>1</sup>/<sub>2</sub>. Two and three columns to page. Column width 2<sup>1</sup>/<sub>2</sub> and 3<sup>1</sup>/<sub>2</sub>.) Bleed page size: 8<sup>1</sup>/<sub>2</sub> wide x 11<sup>1</sup>/<sub>2</sub> deep. Front cover bleed: 6<sup>1</sup>/<sub>2</sub> wide x 8<sup>1</sup>/<sub>2</sub> deep, to bleed right side and bottom only. All engravings, electros, etc. destroyed, if not requested to return, within 1 year of last use.

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To help you choose the best solvent, coupler, plasticizer or diluent for your requirements, we've prepared a six-page booklet, the "Solvent Selector." Ask for a copy from your Technical Representative or write Union Carbide Chemicals Company, Division of Union Carbide Corporation, Room 328, Dept. H, 30 East 42nd Street, New York 17, N. Y.

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# THE COATING CORNER

By  
Phil Heiberger

The author continues his random reflections on various aspects of the paint industry. The opinions expressed in this column are his alone and do not necessarily reflect those of this publication.

As a result of a revived interest in instrumental playing, I had occasion to visit several violin makers and repairers during the past few months. To my surprise, I learned that violin varnishes are still classified "top secret" among those who use them.



P. Heiberger

around his personal varnish source and his application technique.

#### *Lost Art*

Despite the quick-change character of many aspects of our present-day culture, we do encounter, now and again, startling contradictions to the twentieth century's classic cry "Off with the old! On with the new!" In certain areas—notably art, morality, and stringed instruments—we

The quality violin maker of today, like his predecessors, is terribly jealous of his reputation as an artist and craftsman, and he takes pains to nourish a delicate aura of mystery

almost invariably find extreme reverence for the tried and true, for the old and durable.

In such a frame of mind, it's the most natural thing in the world to accept unquestioningly the truism that the old violins made by the Cremona artisans—Stradivari, Amati, Guarneri, Guadagnini, et al—are far superior to any that could possibly be made today because these old masters possessed profound knowledge of a secret art of violin varnish manufacture that has become lost to us.

Furthermore, many violinists, violin makers, and "experts" as well as the austere Encyclopedia Britannica, stand ready to back up this belief. Under *Violin* in the Britannica you may read "Stradivari methods of violin making created a standard for subsequent times; but the secret of his varnish, soft in texture, and shading from orange to red, though much debated, has never been discovered."

#### *Doubts Creep In*

Now twenty years ago as a gullible young music student I was quite willing to accept the

idea of an undiscovered secret. Today as a chemist I'm more skeptical.

How can I believe that unlettered artisans knew more about varnishes and wood finishing in the 18th century than we know today? How can I believe that we cannot understand or duplicate a product that was in common use some 300 years ago?

These questions taunted me until I went to the library to look for the answers. Evidently, I was not the first to harbor doubts, for others had completed extensive research on the subject. My chief informant was Joseph Michelman, who wrote a book entitled, "Violin Varnish—A Plausible Re-Creation of the Varnish Used by the Italian Violin Makers Between the Years 1550 and 1750 A.D." (Published by J. Michelman, 1946) and an article which appeared in *Science*, 112, pp. 337-8 (1950). The Encyclopedia Britannica was also helpful.

#### *Fine Furniture Finish*

In the final analysis, I now realize, the specific problem of making a good violin varnish is intimately related to the general problem of making a good fine-furniture finish. Viewed this way, the details may be of more than passing interest to readers of *Paint and Varnish Production*.

#### *Historical Notes*

Until about 1700, violin playing was a rather crude affair. The violin was held against the chest and was bowed by the left hand. Only the first hand position was known. Intricate technicalities of play were non-existent.

This was the heyday of Italian art and there seems reason to believe that violins were made more for the visual pleasure of art patrons than for musical tone quality. It may well be that the old violin masters were unaware of the remarkable musical value of their products. There is no evidence to show that Stradivari and his contemporaries understood the science of acoustics or that they had exceptional musical ability.

One authority, Oakes (cited by Michelman), claims that Stradivari made both good and bad violins; the good ones were "accidents." He states further that Stradivari

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sold his violins for the equivalent of \$20.

#### Violin Construction

A violin is composed of 70 carefully selected and precisely shaped pieces of wood glued together and varnished. Many factors influence tone—the kinds of woods used, their pre-seasoning, quality and elasticity; thickness of various parts; size and form of the interior, bass-bar, soundpost, lining, and blocks; size and shape of the sound holes, and the angle at which they cross the grain, etc. Structure of wood is such that a varnish treatment is required to cohere, unify, and maintain elasticity. Without varnish a violin quickly loses its initial power and mellowess. A good varnish preserves tone while protecting the wood against deterioration.

#### Source of Superiority

Wherein lies the superiority of the old Italian masterpieces over contemporary violins? Attempts to duplicate Stradivari's models have been notably unsuccessful. On the assumption that the dimensions and construction details were practically identical, the conclusion has been that the difference in tone was attributable to magical properties in the varnish.

But the possibility of keeping a shared secret varnish formula for 200 years seems rather remote. All instruments of that period were quite similar so the art of varnishing was known to literally thousands of people. In fact, the painter, furniture finisher, and the gilder used essentially the same varnish. Significant differences, therefore, must be the result of unique methods of application.

The most enduring varnish is an oil varnish and the best results are obtained when drying conditions are most advantageous. The southern climate of Cremona offered local violin makers clear advantage over colleagues in Germany, France, and England. References indicate that the old masters exposed their violins to the sun; thus slow drying under ultra violet radiation was an important condition.

#### Michelman's Reflections

The simplest way to treat wood is by applying raw linseed oil. This solves the problems of bind-

ing, water proofing, sealing and preservation of appearance. Although there is no direct evidence that linseed oil was the actual interior treatment, Michelman believes that such use would be logical. After all, the old violin makers had plenty of time to allow for the necessarily slow dry. In fact, this very factor may comprise the so-called "secret."

A good violin coating system will contain 6 to 7 thin coats of sub-varnish and 12 thin coats of colored top varnish. Five days to two weeks are allowed for drying and a scrupulous hand rubbing operation is a must between coats. This may account for the fact that all things being equal—craftsmanship, choice of fine woods, finishing—the modern violin maker cannot afford, any more than any other finisher, the luxury of waiting 6 to 8 months while he completes this tedious operation involving the application and maturation of 18 coats of slow drying varnish.

One is led to suspect that this is recognized by all modern violin makers and that their maintenance of a "secret" is merely for purposes of concealing the fact that they must use relatively heavy coats of relatively quick drying varnish.

#### The Purpose of Varnish

Michelman analyzed the purposes of varnish thus: 1. Protection of surface. 2. Preservation of wood. 3. Decorative effect. 4. Improvement of tonal quality.

Only in the latter effect does violin varnish differ from any other industrial coating. Violins, like other woods, always have a variable moisture content. To prevent warping, both interior and exterior surfaces must be coated.

#### Criteria for Formula

In attempting to reconstruct the actual Cremona formula, Michelman listed the conditions which had to be met:

Availability of materials. Only materials available during the period 1550-1750 can be considered.

Color of Wood. The old masters did not dye or stain the wood to obtain the many varieties of colors they used on their violins.

Number of Varnishes. At least two varnishes are recognized. A substratum analogous to a "primer" or "filler," upon which the colored

varnishes were applied. The colored varnish did not always "blende" or "adhere" perfectly.

Transparency of the Varnish. Since all the varnishes were transparent, colored pigments must be excluded.

Reproduction of Color. All varieties of shades of yellow, orange, red, and brown were used.

References to Contemporary Publications. Formulae and recipes were not "secret" in 1550-1750 period. They were widely known and used for 200 years by a large number of violin makers and others.

Durability of the Varnish. The films and colors have survived for several hundred years. All colors are of natural origin.

Next month we'll follow Michelman's reconstruction of the most likely varnish formulation.

#### Arizona Names Distributor

The Whitaker Oil Company, Atlanta, has been named distributor of Acintol tall oil fractions for Georgia for the Arizona Chemical Company.

The Whitaker Oil Company is located at 1557 Marietta Road, S.W. where it maintains extensive warehouse, storage, and drumming facilities. The company operates a fleet of tank trucks for servicing the area.

The Whitaker Oil Company will handle distribution of Arizona's Acintol D distilled tall oil and Acintol FA-1 and FA-2 tall oil fatty acids, in drums and tank trucks.

#### PEMCO Opens Offices

Process Engineering & Machine Co., Inc., Elizabeth, New Jersey, has opened new shops and offices.

The new plant is located at York Street and Dowd Avenue, Elizabeth, N. J.

#### CORRECTION

##### September Issue:

Page 41. Mr. Charles S. Powell is connected with R-Way Furniture Co., Little Falls, N. J.

Page 42. The author of the article, *PROGRESS IN FINISHING METHODS—Aircraft*, is B.T. Graham, Jr., and not J.C. Weaver as indicated.

# NEWS

## N. Y. Club Hears Technical Committees

The technical committee of the New York Paint and Varnish Production Club was the main attraction at the September 4th meeting. A preview of the sub-committee paper to be given at the Federation Convention was featured with reports from five other subcommittees.

The principal part of the program was devoted to the preview of the paper entitled "The Evaporation of Solvents from Coatings." It was the work of sub-committee 66 on solvents. George W. Waters presented the paper.

The following sub-committees of the technical committee made reports:



George W. Waters of the Shell Oil Co., discusses evaporation of solvents from coatings at the September meeting of the New York Production Club.

Sub-Committee #40—Hiding Power - Leonard Schaeffer, Chairman

Sub-Committee #53—Study of Pigment Dispersion - John J. Oates, Chairman

Sub-Committee #67—Color Matching in Production - Benj. Chatzinoff, Chairman

Sub-Committee #70—Industrial Engineering in the Paint Industry - Werner Klugman, Chairman

Sub-Committee #71—Radiation and its Effect on Vehicles - D.F. Koenecke, Chairman

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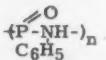
# ABSTRACTS

The following are abstracts of papers presented at the September 8-12 meeting of the American Chemical Society, Division of Paint, Plastics and Printing Ink Chemistry, in Chicago, Ill.

## Polyphosphonamides Derived From Phosphonic Diamides

By H. W. Coover, Jr., Richard L. McConnell, and Newton H. Shearer, Jr., Research Laboratories, Tennessee Eastman Co., Division of Eastman Kodak Co., Kingsport, Tenn.

The heating of phenylphosphonic diamide above its melting point resulted in the liberation of ammonia and formation of a condensation product. The physical properties of these materials varied according to the curing temperature. At 225° to 300°, one mole of ammonia was evolved per mole of phenylphosphonic diamide used, indicating the structural unit to be:



Kinetic data indicated a second-order reaction.

Polyphosphonamides were also obtained when phenylphosphonic diamide or phenylphosphonic dichloride was condensed with urea or thiourea. Many of these polymers may be used as flame-proofing agents for various materials and as light-stabilizing agents for poly(vinyl chloride).

## Thermoplastic Aryl Polycarbonates

By D. W. Fox, General Electric Co., Pittsfield, Mass.

The polyaryl carbonates represent a new and extremely versatile class of thermoplastic resins. Structurally, they are linear superpolyesters in which difunctional phenols and/or bisphenols function as glycols and carbonic acid serves as the difunctional acid. They may be prepared by conventional ester interchange processes or by direct reaction of the acid chloride (phosgene) with the bisphenols in the presence of hydrogen chloride acceptors.

A convenient source of a large variety of bisphenols is the familiar acid-catalyzed condensation of phenols with aldehydes and ketones. A very large number of homo- and co-polycarbonates have been prepared based on bisphenols and dihydroxy aromatics. These polymers are generally characterized by: high impact resistance, softening points in the 200° to 300°C. range, high heat distortion temperatures, relatively low degrees of crystallinity, and good to excellent hydrolytic resistance, thermal stability, and oxidation resistance.

The polycarbonate based on bisphenol-A has an unusually well balanced set of desirable properties. Because of these desirable properties and the commercial availability of the monomer, this polymer has been studied in considerable detail.

## Polyphosphates and Polyphosphonates

By H. W. Coover, Jr., Richard L. McConnell, and Marvin A. McCall, Research Laboratories, Tennessee Eastman Co., Division of Eastman Kodak Co., Kingsport, Tenn.

The condensation of dihydroxy aromatic compounds with phosphorus acid chlorides was studied as a possible method of preparing flameproof polymers.

The condensation of a dihydroxy

aromatic compound in which the hydroxy groups are not ortho to each other with a phosphonic dichloride, aryl phosphorodichloride, a diaryl phosphorochloride, an aryl phosphate, or a diaryl arylphosphonate resulted in formation of a phosphorus-containing polyester. A dihydroxy aromatic compound in which the hydroxy groups are ortho to each other gave a cyclic ester. Anhydrous magnesium chloride was found to be an efficient catalyst for the condensation of a phosphorus acid chloride with an aromatic hydroxy compound. The neutral esters, such as triphenyl phosphate and diphenyl phenylphosphonate, reacted with dihydroxy aromatic compounds to form polyesters through transesterification. Reactants, reaction conditions, catalysts, and physical properties of the



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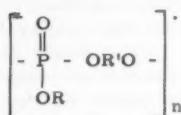
polymers are discussed.

These polymers were generally hard and brittle, and from some of them flame-resistant fibers could be drawn.

#### Aromatic Polyphosphates

By H. Zenftman, Research Department, Nobel Division, Imperial Chemical Industries, Ltd., Stevenston, Ayrshire, Scotland.

In attempts to prepare linear organic polyphosphates of the general type



phosphorodichloridates were made to react with organic dihydroxy compounds with the elimination of hydrogen chloride. It was found that, if either or both of the groups R and R' were aliphatic, the components started to react at room temperature but the elimination of hydrogen chloride was incomplete, and an acidic mixture of products, partially or wholly soluble in water, was obtained. When the phosphorodichloridate and the dihydroxy compound were both aromatic, although the reaction took place less readily, hydrogen chloride was eliminated quantitatively on heating.

By refluxing a monohydric phenol with excess phosphorus oxychloride in the presence of calcium chloride as catalyst, phosphorodichloridates have been obtained from phenol, 1-naphthol, 2-naphthol, and the following substituted phenols: 2-methyl, 2-chloro, 2,3-dichloro, 4-fluoro, 2,4-difluoro, 2,4-dibromo, 2-methyl-4,6-dichloro, 2-phenyl, 4-phenyl, 2-isopropyl, 4-isopropyl, 2-*tert*-butyl, 4-*tert*-butyl, 4-*sym-tert*-octyl. These products were stable to heat and could be distilled at temperatures up to 200°C. and on heating with equimolecular proportions of hydroquinone or 4,4'-dihydroxydiphenyl yielded resinous materials practically free from chlorine. Half the chlorine was eliminated at 140° to 150°C. and the remainder at 170° to 185°C. The properties of the resins depended on the components. They had in general good color and clarity and high refractive index (up to 1.625) and their softening temperatures were between 60° and 150°C. (ball and ring method). They were insoluble in water, alcohols, aliphatic hydrocarbons, but soluble in chloroform, ethylene dichloride, and mixtures of polar and nonpolar solvents. They were resistant to acids but attacked by alkalies. Their intrinsic viscosity was between 0.15 and 0.3. They had a very good adhesion to a large variety of surfaces but had low impact strength. Bond strengths up to 3200 p.s.i. were obtained.

#### Wash Primer—Variation in Chromium Phosphate & Zinc Ions

By E. R. Allen, Leo Ojakaar, Norman Hiller, and Fredi Jakob, Rutgers University, New Brunswick, N.J.

The determination of the fate of chromium(III), chromium(VI), phosphate(III), and zinc(II) in the WP-1 composition necessitated the separation by centrifugation of the pigmentary material, the removal of the resin from the alcoholic vehicle, and the use of an organic-aqueous two-liquid-layer system for the extraction of the ionic ingredients. Because of the formidable difficulties encountered, the resulting distribution picture of the above ionic materials must be viewed as semiquantitative rather than quantitative.

The analytical study of this pigmentary material showed this to be composed 10 and 25% in fresh and aged samples, respectively, of acetic acid-in-

soluble gray-green material, at first thought to be chromium phosphate, but which proved to be over 35% organic matter. It may be a mixture or possibly a complex. Analysis showed 4.9% chromium and 9.81% phosphorus as compared with 35.57 and 21.1%, respectively for CrPO<sub>4</sub>.

Viewing first the fate of the chromium introduced in the pigment, very small percentages of chromium(VI) and but slightly greater amounts of chromium (III) appeared in the aqueous layer of the attractive system. In the 1-hour pigmentary residues the percentage of chromium(VI) and chromium(III) were 5.8 and 1.0, respectively; in the aged samples the counterpart figures were 4.45 and 1.0.

The PO<sub>4</sub><sup>3-</sup> was surprisingly high in the 1-hour aqueous layers and decreased markedly with time; the extreme values of 35 and 3%, respectively, of the added

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$\text{PO}_4^{3-}$  were obtained. The pH values were 3.25 and 2.32, respectively, compared with pH 1.96 for aqueous mono-zinc acid orthophosphate and 0.69 for phosphoric acid, thus indicating the nonexistence of free phosphoric acid in the mix. Appreciable percentages of phosphorus were found in the pigmentary material, presumably zinc phosphate.

The study of the fate of zinc(II) proved disappointing because of analytical difficulties. Definite progress was realized in coping with this problem, but not in time to contribute effectively to this program.

Qualitative and semiquantitative determinations of chromium phosphorus and zinc were made on representative

samples of recovered purified resins. All three elements were found in all samples, with one exception in the case of zinc. Determinable amounts of chromium and phosphorus were found in all of the five samples of resin examined.

The most marked changes with time were the definite decrease in  $\text{PO}_4^{3-}$  and the very decided increased in the insoluble gray-green complex. The methods used are capable of further refinement to a point where the highly desirable quantitative experiments are possible.

#### Resistance of Corrosion

#### Inhibitive Paints

By Henry F. Payne, University of Florida, Gainesville, Fla.

Corrosion-inhibitive paint systems consisting of two coats of primer and two coats of finish were subjected to the standard salt-fog test. Resistance to salt fog was measured by degree of blistering and extent of removal of the paint at two cuts made through the coating to the metal. Results showed that little or no blistering or removal occurred when the film former in the primer was a drying oil. Moderate to severe failure developed when the oil was modified with synthetic resins, or when the resins were used as the entire film former. These results were independent of the type of inhibitive pigment in the primer or the type of finish coat. Free films of the paint systems were subjected to the moisture permeability test, and measurements were made of water absorption in distilled water and 5% sodium chloride solution, in an attempt to relate these properties to the behavior in the salt-fog test.

#### Adsorption From Liquid Mixtures at Solid Surfaces

By C. G. Gasser and J. J. Kipling, The University, Hull, England to be presented by D. B. Keakall, now at New York State College, Alfred, N. J.

It is suggested that four major factors are important in considering adsorption from the liquid phase onto solids:

- (a) the thickness of the adsorbed film,
- (b) the orientation of the adsorbed molecules,
- (c) the polarity of the solid surface,
- (d) the interaction between the liquid components.

These factors may be relevant in assessing the choice and quantitative use of solutes designed to stabilize dispersions when adsorbed at the solid-liquid interface.

As a model for more complex systems, the case of adsorption by active carbon from binary liquid mixtures is considered. Each of the lower fatty alcohols (methyl, ethyl, *n*-propyl, *n*-butyl, *ison*-amyl, and *iso*-amyl) is adsorbed preferentially from mixtures with benzene at low mole fractions of alcohol. At higher mole fractions of alcohol, however, the benzene is preferentially adsorbed. The adsorption of benzene becomes less marked as the chain-length of the alcohol increases, i.e., as the nonpolar hydrocarbon chain becomes increasingly important with respect to the polar hydroxyl group.

The adsorption of each component is calculated on the assumption that the adsorbate is confined to a monolayer. The alcohol molecules are adsorbed with the major axis parallel to the solid surface, in contrast to the perpendicular orientation adopted on more polar surfaces. The effect of inter-

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action between the liquid components is briefly discussed.

#### Surface Chemistry of

##### Oil Soluble Copolymers

By M. J. Schick, F.M. Fowkes, and A. Bondi, Shell Development Company, Emeryville, California

Oil-soluble surface-active copolymers have been prepared from  $C_8-C_{18}$   $\alpha$ -olefines and polar monomers. A polyacetate was prepared with vinyl acetate, a polynitrile with acrylonitrile, and a polyalcohol by hydrolysis of the polyacetate. The ratio of polar to hydrocarbon groups was varied from 1 to 5 and the molecular weight ranged from 5,000 to 40,000.

The extension and aggregation of these polymers in various solvents was determined by sedimentation, diffusion, and viscosity measurements. In hydrocarbon solutions the polymers form aggregates of at least two to ten molecules, but in carbon disulfide, chloroform, or diethylamine there is little aggregation. The configuration of polymers in solution varies from random coils in good solvents (diethylamine for the polyalcohol) to much tighter coils in poor solvents (hydrocarbons). Added water is solubilized as a core for each molecule or aggregate.

Force-area curves in combination with surface potential measurements at the air-water interface indicate that all polar groups are present and oriented in the interface. The monolayers are more expanded and more fluid than the corresponding long chain alcohols, and more stable to collapse or solution than the corresponding monolayers of polyvinyl acetate or polyvinyl alcohol.

The alcohol and the nitrile polymers are very strongly adsorbed at the solid/oil interface, even at elevated temperature. A consequence of this strong adsorption together with the peculiar structure of these compounds is an unusual ability to disperse solids such as neutral and acidic carbon blacks in oils even above 100°C. and up to 200°C. where conventional deflocculants become generally inoperative.

#### Redispersion of Oil

##### Gels in Organic Media

By Max Kronstein, Research Division, College of Engineering, New York University

The paper is concerned with fixed oils; that is, polyhydroxyl alcohol fatty acid esters.

These oils produce three-dimensional, solids, polymerization products or, together with not solidified substance, coherent, insoluble gels. Both of these states can be redispersed into a stable transparent, fluid form without breaking up their Angstrom spacing. The resulting transparent matter has the appearance of a fluid and can be diluted further by suitable liquids without

precipitation. These dispersions can be obtained by heating the three-dimensional oils with metalsoaps or with fluid oils containing metalsoaps and by continuing the heating until the solids or the gels give the appearance of "melting" into a new state of dispersion. Hereby the solids or the gels, as well as the metalsoaps, can be derived from natural or synthetic oils or from animal, plant or synthetic wax-type esters. In the case of the metalsoaps, they can be derived from resin acids or petroleum acids also. In the dispersed state the polymer solids or the dispersed gels are capable of film formation or of further oxidation. The resulting film represents dispersions of the polymer matter and in this fixed state typical characteristics of the polymer solids can be established. These films are tougher, and more elastic, and more solvent resistant than films produced directly from the non pre-polymerized

soluble state.

#### Terpene-Derived Alkyl Pinonate Plasticizers

By H.B. Summers and G.W. Hedrick, Naval Stores Research Station, and F.C. Magne and R.Y. Mayne, Industrial Crops Laboratory, New Orleans, La.

Alkyl pinonates have been prepared in good yield by direct esterification of pinonic acid with higher alcohols, using an acid catalyst and an inert solvent. Lauryl and tridecyl pinonates are effective plasticizers for Vinylite VYDR and Geon 101 vinyl polymers when compared with di-2-ethylhexyl phthalate, except for volatility. The use of an ester of a higher molecular weight alcohol containing a chain length slightly greater than that possessed by either of these alcohols is indicated.

The lauryl and tridecyl pinonates compare favorably with di-2-ethylhexyl

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phthalate in their resistance to attack by fungi, *Aspergillus niger* and *Aspergillus oryzae*.

#### Heat Stabilizers for

#### Nitrocellulose Film

By Gilbert P. Sollott and Fred Einberg, Pitman-Dunn Laboratories, Frankford Arsenal, Philadelphia 37, Pa.

The effects of more than 40 organic compounds on the thermal aging characteristics of nitrocellulose film at 160° F. were investigated. Viscosity measurements of solutions of aging film were used for following the course of degradation, reflecting both the loss of nitrogen dioxide and decrease in chain length.

The compounds found to be best in stabilizing effectiveness are *o*- and *p*-methoxy- and phenylphenols, *N*-nitro-

sodiphenylamine, 2-nitrodiphenylamine, *N*-phenylurethan, vanillin, and *p*-tert-butylphenol. These additives were more effective than such nitrocellulose propellant stabilizers as *s*-diethyl-diphenylurea (ethyl centralite), *uns*-diphenylurea (acardite), diphenylamine and carbazole. *N,N*-Diphenylformamide and *N*-ethyl-*N*-phenylurethan, compounds which have also been used as propellant stabilizers, had little or no stabilizing effect. The results indicated that the substituted phenols, as a class, are at least as effective as aromatic nitrogen-containing stabilizers.

None of the additives inhibited the slow nitrocellulose decomposition resulting from the inherent, spontaneous progress of denitration and chain cleavage. Most of the additives, however, sooner or later inhibited the rapid

degradation attributed to the autocatalytic effect which the decomposition products—i.e., nitrogen oxides and acids—exert on further polymer degradation. The slow rate of degradation occurring in the presence of a stabilizer tended to be the same regardless of the previous history of the nitrocellulose. While previous storage conditions and age were factors in the stability of nitrocellulose toward deterioration at elevated temperature in the absence of an additive, the effect of previous history on high-temperature aging characteristics was virtually eliminated by the addition of stabilizers. Relatively strongly basic compounds caused considerable initial degradation probably via base catalysis, and to some small extent this occurred with a good stabilizer like diphenylamine.

On the basis of several considerations it is suggested that when used in non-excessive amounts, the best heat stabilizers for nitrocellulose are weakly basic, neutral, or weakly acidic compounds which have a high capability of being nitrated, and are good free radical inhibitors at the same time.

#### Action of Poly (Vinyl Butyral) Acid Wash Primers

By R. Ullman and F.R. Eirich, Polymer Institute, The Polytechnic Institute of Brooklyn, Brooklyn, N.Y.

A number of measurements were carried out on the complexing, viscosity, conductance, and adsorption of the poly(vinyl butyral) wash primer with the aim of elucidating the part played by the polymer in the performance of the primer.

The results indicate that structurally the resin undergoes only minor changes while in solution, and all the chromate becomes reduced by solvent alcohol to chromic ions which are complexed with the assistance of the hydroxyl groups of the butyral. The chromic ions further adsorb phosphate ions and the resin thus complexed becomes a poly-electrolyte and polydentate chelating agent.

It is presumably adsorbed as such by polar surface, since the adsorption isotherms lie between those of poly(vinyl acetate) and a poly(vinyl butyral) with free hydroxy groups. On precipitation, the resin becomes partially cross-linked by acetal and presumably also by salt bridges.

#### Corrosion-Inhibiting In PVAc Primers

By J. C. Baatz, Shawinigan Resins Corp., Springfield, Mass.

The presence of water in emulsion-based paints has limited their use on metal surfaces. Some efforts have been directed at reducing corrosion in the paint container before the paint itself

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Pigment dispersions in nitrocellulose; ethyl cellulose; urea formaldehyde; vinyl and alkyd resins; chlorinated rubber and other plastic binders.

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was used; however, the work under discussion here was concerned with corrosion prevention by a dry paint film. The work was performed with a series of four corrosion-inhibiting pigments all containing a chromate portion, and five corrosion-inhibiting additives.

With respect to a normal emulsion-based paint formulation, a definite improvement in corrosion prevention on surfaces normally susceptible to corrosion was attained using an emulsion-based binder and a chromate pigment or an emulsion-based binder and an inhibiting additive. This could be observed both when the pigment and additive were used separately and when a combination of pigment and additive was used. Of the additives and pigments investigated, the most significant improvement was obtained with sodium nitrite and zinc yellow, respectively. A combination of these two, together with a surface tension depressant to facilitate wetting of the metal surface, provided the maximum in corrosion prevention in the series of test under discussion.

#### Wash Primer WP-1, Variation in Resin

By E. R. Allen and S. M. Hirshfield, Rutgers University, New Brunswick, N.J.

Previously reported work [J. Polymer Sci. 27, 285-94 (1958)] has shown that under conditions simulating those existing in WP-1 some hydrolysis of the acetal linkage of the poly(vinyl butyral) resin does occur, and that this change is accelerated by the presence of chromium<sup>+3</sup> salts. This work has now been extended to the study of WP-1 itself with particular emphasis on the recovery, purification, and characterization of the resin from fractions of the mix taken at different periods of aging. Special techniques were developed for centrifuging out the pigmentary material without the distorting dilution of the mix. The resin was recovered from the centrifuge again using specially developed methods, based on dilution with a suitable nonsolvent, followed by shaking out with water, then washing and freeze drying the separated resin. This recovered and purified resin was evaluated by viscosity determinations and by butyraldehyde determinations by standard procedures.

Viscosity determinations showed a rapid drop in intrinsic viscosity of the resin from the 2.5-hour sample. A gradual decrease in this property is shown with time up to 1 week. Likewise the phosphoric acid in the mix showed a marked drop at the start and a continuing but slower decrease up to 1 week. There was no indication of an abrupt break in this decrease in either of the phenomena. A very slight, scarcely significant, decrease in butyraldehyde content was shown by the

the various samples of recovered resin.

#### Microstructure of Styrene Copolymers

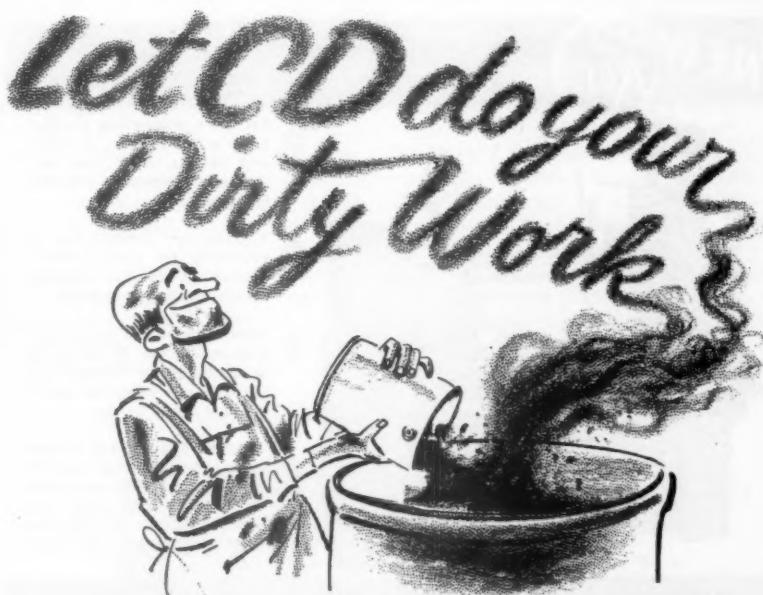
By M. Parker, A. S. Powell, O. Kao, and E. G. Bobalek, Case Institute of Technology, Cleveland 6, Ohio.

Variable conditions of reaction of styrene with unsaturated polyesters in glass-reinforced plastics tend to produce plastics having poorly reproducible mechanical properties. This variance might be explained by assuming that varying degrees of homopolymerization of styrene occur along with copolymerization to yield incompatible mixtures of polymers. Direct evidence to confirm this heterogeneity hypothesis was sought by electron microscopy examination of re-

plicas of fracture sections of polymers and of glass-polymer laminates. Films of polymer were examined also with the phase microscope.

Phase microscopy was unable to establish that anything except a homogeneous polymer phase was formed by any variation of reaction conditions except when the system was contaminated by addition of polystyrene before polymerization was initiated. Electron microscopy also showed fracture characteristics which are typical of homogeneous polymers.

Some micrographs of adhesive breaks between glass and polymer are shown which demonstrate the effect of adhesion-promoting surface treatments of the glass.



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**TME and TMP**  
(From page 67)

**FOAM PREPARATION**

Polyester	30
Water	0.7
Triethanolamine	2.0
Nacoone	26.0

A fine texture rigid low density foam results.

Another promising area of utility is in wire enamels, where the unusual heat resistance qualities of trimethylolethane and trimethylolpropane are utilized. A polyester is prepared from dibasic acid or a suitable derivative and this is subsequently modified with a masked polyisocyanate.

**TME** 4 moles 496  
**Phthalic anhydride** 3 moles 444  
Heat in a solvent type cook (xylol) at 235°C. to an acid number of 2 or less.

These polyols are also potential ingredients of plasticizers for vinyls, nitrocellulose, and other cellulose esters and synthetic lubricants where heat stability is a necessary feature of service.

**Conclusion**

Trimethylolethane and trimethylolpropane provide the following qualities for consideration in appliance, automotive, metal decorating, and general industrial topcoat vehicles.

1. Heat stability and resistance to overbake
2. Gloss retention
3. Color retention
4. Alkali and detergent resistance
5. Exposure resistance and weatherability
6. Resin compatibility

The metal adhesion and resistance qualities of TME resins are important in their use in metal primers and finishes.

With the use of lower cost ingredients such as tall oil fatty acids and the opportunity of using lower contents of modified resin such as melamine formaldehyde, it is possible to achieve high quality at low costs with systems based on these polyols.

Increasing interest is developing in the use of both trimethylolethane and trimethylolpropane in flexible and rigid foams and in other applications where their stability and other properties offer advantages.

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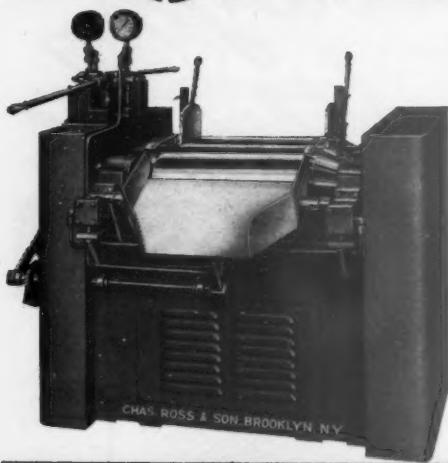
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**Catalin Foreign Agreement**

Catalin Corporation of America will manufacture and sell emulsions and solutions of acrylic polymers used for plastic paints, coating, and adhesive applications under the terms of a ten-year license agreement with Union Chimique Belge, S.A., Brussels, Belgium, has been announced by Harry Krehbiel, president of Catalin.

Union Chimique Belge, a manufacturer of chemicals in Europe, will supply to Catalin all data and information required for the manufacture of the products covered in the agreement. Catalin, a major U.S. supplier of plastic materials and special chemicals, will produce the chemical specialties in three plants located at Fords, N. J., Thomasville, N. C., and Calumet City, Ill.

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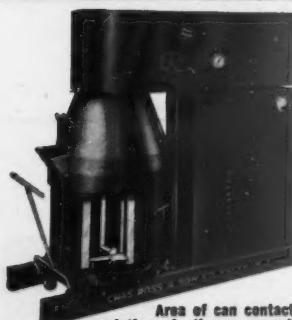
1 Pressure indicating gauges provide greater ease in properly setting rolls, and less skill or experience is required by operator.

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3 Special equalizers assure positive parallelism of roll faces at all times for uniform dispersions and minimum maintenance costs.

4 Mills have quick roll release with safety overload feature, and are convertible for either fixed or floating center roll operation. 2½x5, 4½x10, 6x14, 9x24, 12x30, 14x32, and 16x40" sizes.

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• Extra heavy construction and standard type motor eliminate costly downtime. oversized motor drives can be provided for kneading and mixing extremely heavy materials. 1, 2, 3, 4, 5, 6, 12, 25, 50, 65, 85, 125 and 150 gallon sizes.

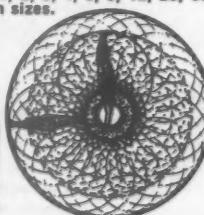
Area of can contacted by stirrers during only one revolution of stirrers around can (2 seconds). Position of stirrers advances 4½" with each successive revolution to sweep entire area and all points on sides of can. Stirrers overlap each other as well as center of can.

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## SORBITOL

(From page 56)

gums are compatible with both varnishes and nitrocellulose lacquers. High maleic content resins esterified with sorbitol-pentaerythritol combinations are also lacquer compatible. When modified with plasticizing oils or fatty acids these resins exhibit a combination of excellent cold check resistance with desirable sanding and rubbing properties.

To obtain products of low acid numbers it is recommended that sorbitol be used in conjunction with 20-40% pentaerythritol. Pentaerythritol is preferred over glycerine as the auxiliary polyol because the drying rates of its esters more closely approach those of sorbitol esters. For certain applications where low viscosity is desired, sorbitol can be used with glycerine to give economically favorable products of low acid values.

### References

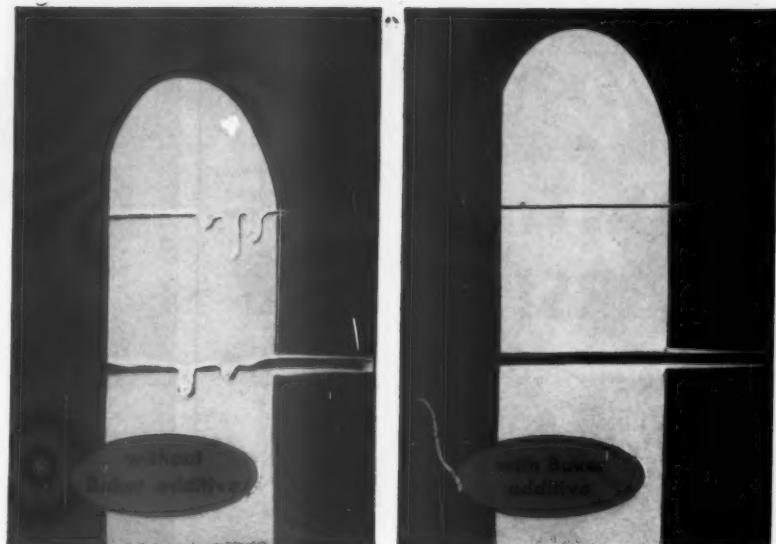
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### N.Y. Pigment Club Schedule

The New York Pigment Club in its fifth year announces the following guest speakers for the opening phase of the 1958 - 1959 season:

OCTOBER 9. Hugh F. Purcell, Morehouse-Cowles, Inc. "Modern Pigment Dispersion Methods"  
NOVEMBER 13. John H. L. Watson, M. W. Freeman Co. "Practical Applications of Submicron Crystal Pigments"  
DECEMBER 11. Louis J. Venuto, Columbian Carbon Co. "The Special Factors Influencing Carbon Black Dispersions"  
JANUARY 8. R. L. Whitney and R. P. Bates, National Lead Co. "New Developments in Corrosion Inhibitive Pigments"

The New York Pigment Club holds all its regular meetings at Fraunces Tavern, Broad and Pearl Streets, N.Y.C. at 6:30 P.M.. For dinner reservations please contact Robert Copland, secretary, L & R Organic Products, 50 White St., N.Y.C.



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**Oct. 20-22.** American Oil Chemists Society, Fall Meeting, Sherman Hotel, Chicago.

**Oct. 27-29.** Seventy-first annual convention of the National Paint, Varnish & Lacquer Assn., Shoreham Hotel, Washington, D. C.

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**Chicago**, 1st Monday, Furniture Mart.

**C.D.I.C.**, 2nd Monday, Cincinnati — Oct., Dec., Mar., May, Hotel Alms.

**Dayton** — Nov., Feb., April, Suttimilers.

**Columbus** — Jan., June, Sept., Fort Hayes Hotel.

**Cleveland**, 3rd Friday, Harvey Restaurant.

**Dallas**, 1st Thursday after 2nd Monday, Melrose Hotel.

**Detroit**, 4th Tuesday, Rackham Building.

**Golden Gate**, 3rd Monday,abella's Restaurant, San Francisco.

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**Kansas City**, 2nd Thursday, Pickwick Hotel.

**Los Angeles**, 2nd Wednesday, Scully's Cafe.

**Louisville**, 3rd Wednesday, Seelbach Hotel.

**Montreal**, 1st Wednesday, Queen's Hotel.

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**New York**, 1st Thursday, Brass Rail, 100 Park Ave.

**Northwestern**, 1st Friday, St. Paul Town and Country Club.

**Pacific Northwest**, 3rd Thursday, Washington Athletic Club, Seattle, Wash.

**Philadelphia**, 3rd Wednesday, Philadelphia Rifle Club.

**Pittsburgh**, 1st Monday, Gateway Plaza, Bldg. 2.

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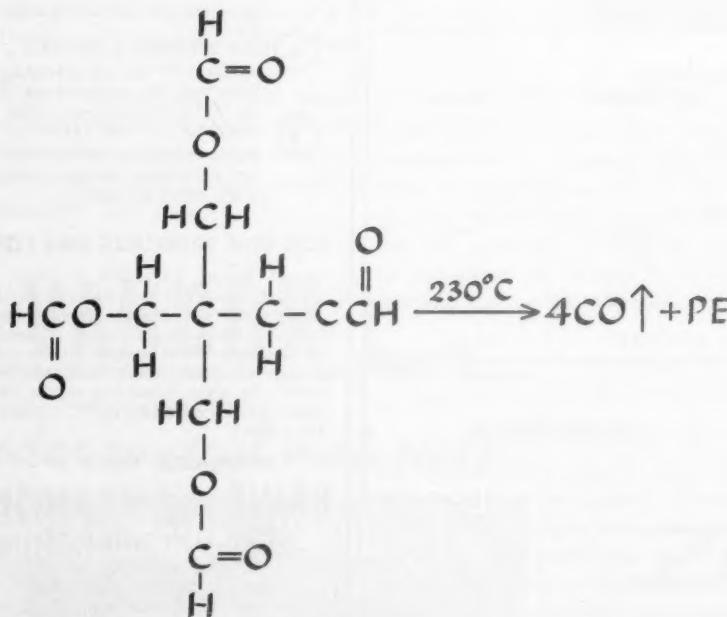
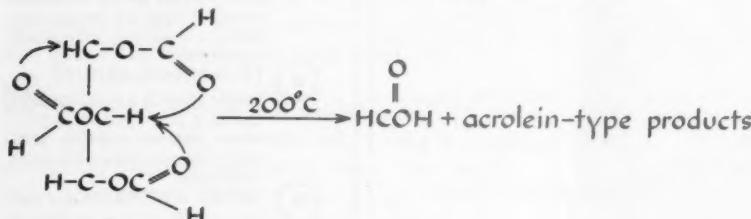
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## PENTAERYTHRITOL

(From page 53)

standing resistance to heat, light, and moisture. This is observed in the alkyd resins, plasticizers, rosin esters, and high molecular weight polymers. For the most part, this stability may be traced to the neopentyl structure of the PE molecule as shown above. In Penton, for example, the absence of a hydrogen atom on the carbon adjacent to the chloromethyl group accounts for the fact that hydrogen chloride is not split off from the polymer under the sustained heat of molding. The pyrolysis of formic esters of glycerin and pentaerythritol provide another example. Because the formic acid ester of glycerine has a hydrogen atom on the carbon atom adjacent to that carbon atom with the carbonyl group, splitting out of formic acid is facilitated, resulting in decomposition. (Equation B).



In the formic acid ester of pentaerythritol, no hydrogen is present on this carbon atom; thus, decomposition of the alcohol does not occur under similar conditions. (Equation C)

Research is continuing to develop the chemistry of the PE molecule and ways of utilizing it to a technical and economical advantage. As this chemistry becomes better understood, the use pattern of PE and its derivatives will continue to expand at a rapid rate.

### Acknowledgment

The author wishes to acknowledge the information supplied by the Synthetic Research Division Product Applications Laboratory, in particular by Mr. C. J. Campbell, Mr. R. P. Silver, Mr. V. J. Larson, Mr. J. P. Landig, and Dr. H. W. Turner.

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## GLUCOSIDE

(From page 63)

ings), these varnishes heat-cure to films which have good fabricating and soldering properties in addition to excellent water, alkali and organic acid resistance. These varnishes can be prepared in 12 to 20 gallon oil-length (a ratio of 12 to 20 gallons of alkyd to 100 pounds of resin) by cooking the alkyd with a heat-reactive resin, such as Bakelite resin BR10282 at 265° F. to 285° F., or equal parts of Bakelite resin BR10282 and Panarez 6-210 at 300° F. to 335° F. The varnishes are cooked until a sample gives a Gardner-Holdt viscosity of F to G at 35 per cent NVM in xylene-mineral spirits (20% xylene-80% mineral spirits), then thinned to this solids content. The addition of 0.05% manganese drier on the solids and baking at 400° F. for 10 to 12 minutes will cure the coatings.

Modification of semi-drying oils (soybean oil) with methyl glucoside and maleic anhydride or fumaric acid (3 to 5% maleic or fumaric modification) up-grade these oils so that their drying and film characteristics are comparable to the more highly unsaturated natural drying oils.

In Table VII are given typical heating cycles for the preparation, and also some of the properties, of various oil-modified alkyd resins made with methyl glucoside. In all these preparations, the oil was first alcoholized with the methyl glucoside following the procedure outlined previously. After the dibasic acid addition, fusion cooking with a carbon dioxide sparge (0.02 - 0.04 cu.ft./min./gal.) was employed to complete the cooks. Comparison of the film properties of various methyl glucoside-tetrahydrophthalic (MG-THPA) alkyls with several commercial resins are given in Table VIII. For the drying times and Sward Hardness values, films of 3 and 5 mil wet thickness depending on the solids content of the resin, were laid down to as to give approximately the same dry film thickness. As can be seen from these data, the methyl glucoside alkyls were su-

perior in drying time, Sward Hardness and water resistance to the commercial products. None of the resin had good alkali resistance, although the methyl glucoside alkyls were slightly better in this respect also.

### Conclusion

By improvement in reaction techniques, it is now possible to manufacture light-colored reconstituted drying oils, varnishes and alkyd resins that body and dry rapidly to films with excellent adhesion, gloss, flexibility, hardness, through-dry and water resistance. In the face of rising raw material costs, the low price of

methyl glucoside makes this tetra-functional, cyclic polyol more attractive than ever for use in the manufacture of resins, coatings, inks, core-binders and linoleum bases.

### Harry Lipman Passes

Harry Lipman, president of Acme Shellac Products Co. and United Shellac Corp. died recently after a brief illness. His age was 57.

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SYLOID 73 • SYLOID 75 • SYLOID 162 • SYLOID 161 • SYLOID 404

## GLYCOLS

(From page 69)

ants has an important bearing on the suitability of the product for specific uses. The reactivity of the resin and variations in its hardness and flexibility may be effected by the amount and choice of various saturated dibasic acids used to partially replace the unsaturated dibasic acid. Similar modifications are possible by variations in the type of glycol. Diethylene glycol is also used in formulation of this type of resin. Propylene glycol polyesters, especially propylene glycol fumarate polyesters, tend to be less crystalline and more soluble in styrene than their ethylene glycol counterparts.

In use, these unsaturated polyesters are blended with a reactive vinyl monomer (styrene is the most commonly used). The vinyl monomer content of the mixture ranges from 30 to 50 per cent; the polyesters are essentially supplied

as solutions in styrene. The vinyl monomer serves a dual purpose in providing solutions of controllable and moderate viscosity and as a reactive material.

Although the coating applications of unsaturated polyesters are significant and are expanding in importance, the major market for such resins is in the manufacture of glass fiber reinforced plastic products.

### Hexanetriol

Alkyd-type resins for various special applications can be formed by the reaction of hexanetriol with dibasic acids. These include baking alkyds, drying and semi-drying alkyds, and nonidrying alkyds for use with nitrocellulose and urea-formaldehyde resins. In surface coatings, these resins should be superior in flexibility, water resistance, and resistance to organic solvents. Also, alkyds for specific needs may be made by reacting various mixtures of glycerol and hexanetriol with dibasic acids or dibasic acid anhydrides.

When polyester resins contain-

ing hexanetriol are reacted with isocyanates to give polyurethanes, excellent protective coating materials are obtained. They are highly resistant to weather and abrasion, have good gloss and electrical properties, and low gas permeability. Thus, they are particularly desirable for coating applications in the electrical industry.

### Polyethylene Glycols

Esterification of diethylene and triethylene glycols with dicarboxylic acids produces a variety of resins. Polyesters prepared from the polyglycols tend to be more flexible and less crystalline than those based on ethylene glycol. However, they also tend to be somewhat more water-sensitive and to have less favorable electrical characteristics than corresponding resins derived from ethylene glycol.

### Plasticizer Application

Some polyesters are soft resins which find application in surface coatings where their performance properties and compatibility characteristics can be used to advantage. Their use is primarily as plasticizers for lacquers based on nitrocellulose, vinyl solution resins, ethyl cellulose, and acrylic ester resins.

### Ethylene Glycol

Rosin esters of ethylene glycol are used as plasticizers in lacquers and enamels; monobasic acid esters of ethylene glycol are used as solvents and plasticizers.

### Propylene Glycol

Rosin ester derivatives of propylene glycol are useful as plasticizers for lacquers and paints.

### Hexanetriol

1,2,6-Hexanetriol reacts with acetic, propionic, and fatty acids to form esters with excellent plasticizing properties.

### Polyethylene Glycols

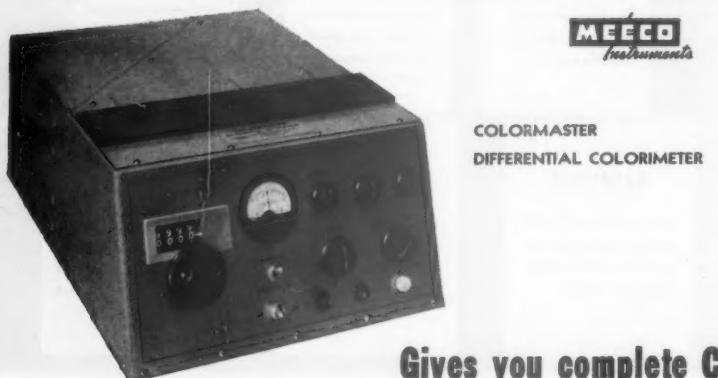
Diethylene and triethylene glycol, like the other glycols, form both mono- and di-esters, many of which are plasticizers.

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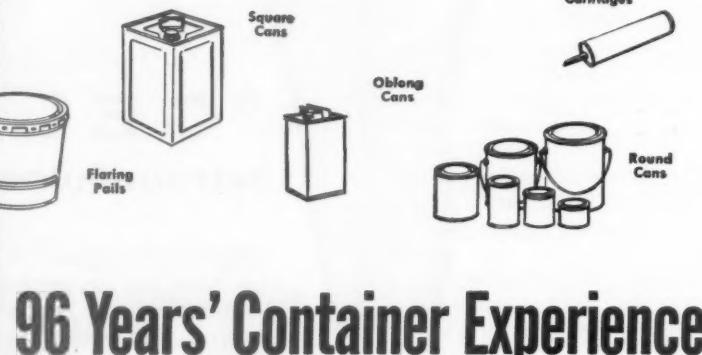
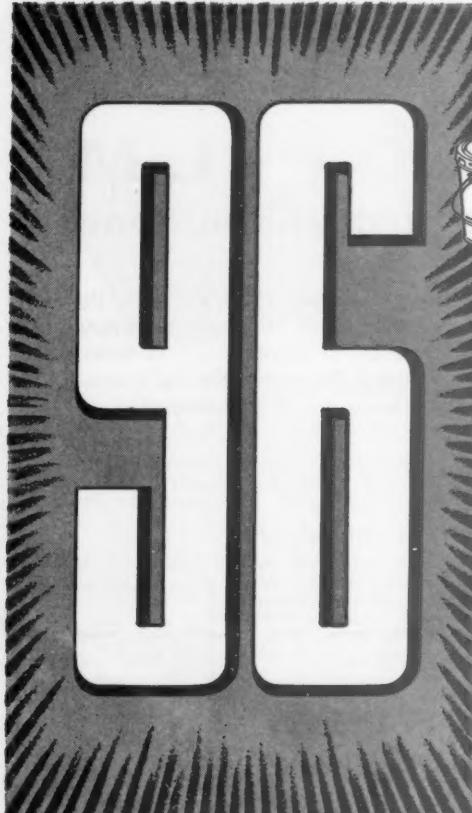
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